

Perioperative Management of Antithrombotic Medications: An Investigation into Current U. S. Ophthalmologic Recommendations

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Abstract

Purpose: To investigate the availability and content of educational statements or recommendations disseminated by U. S. ophthalmologic organizations regarding perioperative management of antithrombotic agents for ophthalmic and orbital surgery, given the highly variable management of these agents by U. S. ophthalmologists and limited consensus recommendations in the literature.

Methods: National U. S. ophthalmic surgical organization websites were systematically examined for educational statements, which were reviewed for discussion of perioperative management of antithrombotic agents including antiplatelet and anticoagulant medications. A “statement” was defined as either: (a) a guideline directed toward ophthalmologists or (b) a surgical/clinical educational posting directed toward ophthalmologists or patients.

Results: Fourteen surgical organizations were identified, with eight of these publishing clinical/surgical educational statements. A total of 3408 organizational statements were identified, with 252 (7.4%) and 3156 (92.6%) statements directed toward physicians and patients, respectively. In total, 0.3% (9/3408) of statements discussed perioperative management of antithrombotics. These accounted for 0.8% (2/252) of ophthalmologist-directed statements and 0.2% (7/3156) of patient-directed statements. The majority of patient-directed statements (57.1%, 4/7) recommended that patients discuss antithrombotic cessation with their ophthalmologists, though ophthalmologist-directed information regarding these medications was scant or absent.

Conclusions: Educational material from U. S. ophthalmologic organizations regarding perioperative management of antithrombotics is notably lacking despite the fact that ophthalmic and orbital surgeries carry unique vision-threatening hemorrhagic risks. Given these risks, as well as the medicolegal consequences of hemorrhagic complications in ophthalmic surgery, increased dissemination of educational material, and consensus statements by ophthalmic surgical organizations on the perioperative management of antithrombotics may be justified.

Keywords: Anticoagulant, Anti-platelet, Antithrombotics, Hemorrhage, Ophthalmic surgery, Ophthalmologic organizations, Vision loss

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INTRODUCTION

In ophthalmic and orbital surgery, perioperative use of antithrombotic medications may significantly increase bleeding risk in certain procedures and cause significant morbidity. While many ophthalmologic procedures are performed safely without cessation of antithrombotic agents, others routinely require consideration of antithrombotic interruption due to potential vision-threatening hemorrhagic risks. In

trabeculectomy surgery, for example, use of aspirin has been associated with a 50.9% incidence of vision-threatening hyphema, compared to 28.0% in nonusers.¹ Eyelid or orbital surgeries performed on patients taking certain antithrombotics in the perioperative period may substantially increase the risk of orbital hemorrhage and permanent vision loss.²⁻⁴ In addition, Tsirbas and McNab found that 40% of cases of delayed epistaxis – a potentially life-threatening occurrence – identified after lacrimal surgery involved ongoing use of nonsteroidal

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anti-inflammatory drugs (NSAIDs).⁵ Further, in procedures where many antithrombotics are often not discontinued, such as cataract surgery, the addition of an anesthetic block may increase orbital hemorrhagic risk by 5-fold.⁶

The perioperative management of antithrombotic agents is variable among U. S. ophthalmologists. Decisions regarding initiation and duration of antithrombotic interruption are often based on surgeon preference, institutional or departmental trends, or left to the discretion of co-managing providers. The ophthalmologist and co-managing physicians must balance both the hemorrhagic and thrombotic risk factors, which should involve a meticulous assessment of potential sight-threatening versus life-threatening complications and their medical legal implications.

Perceived negligence on the part of the ophthalmologist can result in profoundly costly litigation. For example, in 2014, a monocular woman on aspirin and clopidogrel successfully won a malpractice lawsuit for \$825,000 against her ophthalmologist after an elective pars plana vitrectomy with excessive intraoperative bleeding and subsequent retinal detachment left her legally blind in her only-sighted eye.⁷

Various U. S. surgical organizations outside the realm of ophthalmology provide position statements, commentary, and educational material on their websites for physicians regarding preferred perioperative management of various antithrombotic agents, with many organizations providing specific suggestions or guidelines.⁸⁻¹⁵ Many U. S. ophthalmologic organizations publish statements regarding recommendations for preferred management of various ophthalmic clinical and surgical scenarios, as well as patient-directed informational articles. However, to date, no study has investigated the availability of U. S. ophthalmologic organizational statements that specifically address perioperative management of antithrombotic medications.

We suspected that the substantial variability in the management of antithrombotic agents – which include antiplatelets and anticoagulants – by ophthalmologists may in part stem from a paucity of educational or consensus statements disseminated by U. S. ophthalmologic organizations regarding antithrombotics. The purpose of this investigation was to assess the availability and content of educational statements on U. S. ophthalmic surgical organization websites regarding perioperative management of antithrombotic medications in ophthalmic, periorbital, and orbital surgery. The authors hypothesized that limited resources are available from national U. S. ophthalmic organizations to help guide U. S. ophthalmologists in this regard.

METHODS

Search criteria and study design

National U. S. ophthalmic surgical organizations were identified using the following terms on free online search engines: “U. S. ophthalmic surgery organizations;” “U. S. ophthalmic surgery societies;” and “U. S. ophthalmic surgical

associations.” The terms “United States” and “American” were also used in place of “U. S.”; “eye,” “vision,” and “ophthalmology” were used in place of “ophthalmic” in these search terms. Search engines used were www.google.com, www.bing.com, and www.yahoo.com. Statements directed to either ophthalmologists or patients published on the websites of identified national U. S. ophthalmic surgical organizations as of March 1, 2020 were then systematically analyzed. Organizations were included in our search only if they have held annual national or international meetings that accept research abstracts and/or presentations, to avoid inclusion of organizations without a well-defined education-based mission.

Organization inclusion and exclusion criteria

Ophthalmic surgical organizations were defined as those with an education-based focus on both ophthalmic surgical and clinical practice. U. S. organizations were defined as those with headquarters located in the U. S., regardless of whether membership is international. Although use of antithrombotics in children is significantly less common than in adults, organizations with a pediatric surgical focus were nonetheless included in the analyses. Organizations with a regional or local focus were not included in our search criteria.

Identification of organizational statements

A “statement” was required to be written entirely in English and was defined as either: (a) a surgical or clinical guideline or recommendation directed toward ophthalmologists, or (b) a surgical or clinical educational article or posting directed toward either ophthalmologists or patients. Peer-reviewed literature, white papers, or other indexed educational material were only evaluated if the entirety of the article’s text, or a link to the entire text, was made available on the organization’s website, and the organization provided remarks on their website regarding the article.

Statements were required to be listed under headings such as a “Guidelines” or “Information for Patients,” rather than submitted commentary or news articles not clearly reflective of an organizational statement or proceeding.

For identification of statements discussing antithrombotics, an “antithrombotic” was considered any prescription or over-the-counter medication with a primary purpose of reducing formation of thrombi. This included antiplatelet agents (e.g., aspirin, clopidogrel, ticagrelor, prasugrel, etc.) and anticoagulant medications, the latter of which included traditional agents (e.g., warfarin, etc.) and direct oral anticoagulants (DOACs, e.g., apixaban, rivaroxaban, dabigatran, etc.). Medications or supplements known to reduce the formation of thrombi but with other more common indications (e.g., ginkgo biloba or NSAIDs other than aspirin) were only considered antithrombotics in these analyses if the organizational statement presented them in this regard. Accordingly, statements regarding such medications were not considered to be statements on antithrombotics if the medications were only discussed in the context of their use for other purposes (e. g. the use of NSAIDs for analgesia).

Quantitative analysis

The total number of statements on each organization's website was quantified, and all statements were reviewed in entirety. Each statement was examined for mention of antithrombotic medications; statements identified to provide such discussion were then further assessed for mention of these medications in a perioperative context.

RESULTS

Identification of organizations

Fourteen national U. S. organizations with a focus on ophthalmic surgery were identified. Among these organizations reviewed, eight fulfilled inclusion criteria. Six organizations were found to provide neither physician nor patient educational or guideline materials. These included the following organizations: Retina Society, Macula Society, Cornea Society, American Ophthalmological Society, American Osteopathic Colleges of Ophthalmology and Otolaryngology Head and Neck Surgery, and Ophthalmic Anesthesia Society.

Statements directed toward ophthalmologists

Among the eight organizations included in further analyses, 252 ophthalmologist-directed statements were identified, with only three statements involving the mention of antithrombotic medications [Table 1]. All statements regarding antithrombotics were provided by one organization (12.5%, 1/8), the American Academy of Ophthalmology (AAO). Of these three statements, two specifically discussed perioperative management of these medications (0.8%, 2/252), and composed 1.1% of ophthalmologist-directed statements (2/178) disseminated by the AAO. Both of these statements discussed antithrombotic management as it relates to cataract surgery; a summary of these statements is presented in Table 2.

The first statement on cataract surgery – a Preferred Practice Pattern guideline article – recommended the continuation of anticoagulants if preoperative International Normalized

Ratio (INR) is in therapeutic range and that aspirin should only be discontinued perioperatively if the risk of bleeding outweighs potential benefits of the medication.¹⁶ The second statement on cataract surgery – an excerpt from the Basic and Clinical Science Course (BCSC) textbook series – outlines anesthetic and intraoperative strategies that may minimize hemorrhagic risk and forestall need to discontinue anticoagulants perioperatively.¹⁷ It further stresses that the decision may vary depending on the indication for anticoagulation and notes the approximate number of days needed for restoration of normal coagulation or platelet function after discontinuation of certain antithrombotic agents. Both statements remark that the management of patients on antithrombotics must be tailored on a case-by-case basis, with the BCSC excerpt highlighting the need for co-management with the patient's primary care physician in these decisions.

No ophthalmologist-directed statements from any organization regarding perioperative management of antithrombotics in other subspecialty surgical areas such as vitreoretinal surgery, glaucoma surgery, corneal surgery, or ophthalmic plastic surgery were identified. Three organizations that published patient-directed statements did not also publish ophthalmologist-directed statements [37.5%, 3/8; Table 1].

Statements directed toward patients

The majority of organizations provided patient-directed statements [87.5%, 7/8; Table 3]. A total of 3156 statements for patients were identified, with the majority from the AAO (91.9%, 2902/3156) and the American Association for Pediatric Ophthalmology and Strabismus (AAPOS; 4.7%, 149/3156). A small proportion of these statements (0.5%, 15/3156) involve mention of antithrombotic agents, with 0.2% (7/3156) providing information to patients specifically regarding perioperative use of these medications.

The content of these patient-directed statements is outlined in Table 4. These include six "Ask an Ophthalmologist" statements from the AAO and one educational article

Table 1: Online statements directed toward ophthalmologists by United States ophthalmologic organizations*

Organization	A Total statements (n)	B Statements on antithrombotics, n (percentage of column A), n (%)	C Statements on perioperative management of antithrombotics, n (percentage of column B, percentage of column A), n (%)
AAO	178	3 (1.7)	2 (66.7, 1.1)
ASCRS	42	0	0
AAPOS	19	0	0
AGS	11	0	0
ASOPRS	4	0	0
ASRS	0	0	0
NANOS	0	0	0
ACES and ABES	0	0	0
Total	252	3 (1.2)	2 (66.7, 0.8)

*Statements include: Policies, guidelines, or educational articles or chapters directed toward ophthalmologists. AAO: American Academy of Ophthalmology, ASCRS: American Society of Cataract and Refractive Surgery, AAPOS: American Association for Pediatric Ophthalmology and Strabismus, AGS: American Glaucoma Society, ASOPRS: American Society of Ophthalmic Plastic and Reconstructive Surgery, ASRS: American Society of Retinal Specialists, NANOS: North American Neuro-Ophthalmology Society, ACES: American College of Eye Surgeons, ABES: American Board of Eye Surgery

Table 2: Summary of online statements by United States ophthalmologic organizations discussing perioperative use of antithrombotic medications*

Organization	Statement type	Statement topic	Statement summary
AAO	Preferred practice pattern article ¹⁶	Cataract surgery	Continuation of anticoagulants acceptable if INR therapeutic (I+ grade, good quality, strong recommendation) Discontinue aspirin perioperatively only if bleeding risk outweighs antiplatelet benefits (I- grade, good quality, strong recommendation) Management of patients on antithrombotics should be customized on a case-by-case basis
AAO	BCSC excerpt ¹⁷	Cataract surgery	The ophthalmologist and primary care physician together should weigh systemic versus ocular surgical risks in deciding whether to interrupt or continue antithrombotics, and cases should be tailored on an individual basis Patients with atrial fibrillation or single DVT episode may be able to discontinue warfarin perioperatively; patients with prosthetic heart valve or recurrent DVT may require dose lowering rather than discontinuation Normal coagulation may require 3-5 days after stopping warfarin; restoration of platelet function requires at least 10 days after stopping antiplatelets Topical anesthesia or sub-tenon infusion, clear corneal incision, and IOL placement in the capsular bag may minimize hemorrhagic risk and forestall need to discontinue anticoagulants perioperatively Retrolbulbar and peribulbar anesthetic injections increase risk of retrobulbar hemorrhage in these patients; the reverse trendelenburg position may lower this risk

*Statements include: Policies, guidelines, or educational articles or chapters directed toward ophthalmologists. INR: International normalized ratio, DVT: Deep vein thrombosis, AAO: American Academy of Ophthalmology, BCSC: Basic and Clinical Science Course, IOL: Intraocular lens

Table 3: Online statements directed toward patients by United States ophthalmologic organizations*

Organization	A Total statements (n)	B Statements on antithrombotics, n (percentage of column A), n (%)	C Statements on perioperative management of antithrombotics, n (percentage of column B, percentage of column A), n (%)
AAO	2902	12	6 (54.5, 0.4)
ASCRS	0	0	0
AGS	16	0	0
AAPOS	149	1 (0.7)	0
ASOPRS	18	1	1 (100, 5.6)
ASRS	40	1 (2.5)	0
NANOS	21	0	0
ACES and ABES	10	0	0
Total	3156	15 (0.4)	7 (50, 0.2)

*Statements include: Educational articles or "question and answer" statements directed toward patients. AAO: American Academy of Ophthalmology, ASCRS: American Society of Cataract and Refractive Surgery, AAPOS: American Association for Pediatric Ophthalmology and Strabismus, AGS: American Glaucoma Society, ASOPRS: American Society of Ophthalmic Plastic and Reconstructive Surgery, ASRS: American Society of Retinal Specialists, NANOS: North American Neuro-Ophthalmology Society, ACES: American College of Eye Surgeons, ABES: American Board of Eye Surgery

published by the American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS). Of the AAO statements, two indicate that intravitreal injections are safe in patients taking warfarin or oral NSAIDs,^{18,19} three suggest that cataract surgery may be acceptable in patients taking anticoagulants or antiplatelets,²⁰⁻²² and one reported that an unspecified laser eye surgery likely does not have any effect on warfarin dosing or efficacy.²³ An ASOPRS educational article on blepharoplasty and brow ptosis repair explains that aspirin, NSAIDs, and anticoagulants are to be avoided before and after these surgeries.²⁴ None of these statements outline specific information or criteria about preferred duration or time course of antithrombotic therapy cessation, and many emphasize that patients should discuss their individual case with their own ophthalmologist (57.1%, 4/7).

Overall quantitation of statements

Including both the above-mentioned ophthalmologist-directed and patient-directed statements, a total of 3408 statements were identified. Eighteen of these statements (0.5%) were regarding antithrombotic medications, with nine (0.3%) focusing on perioperative management of these drugs.

DISCUSSION

This investigation reveals that the preponderance of U. S. ophthalmic surgical organizations provide few or no statements regarding perioperative antithrombotic management. This was suspected, given substantial variability in the management of these medications by U. S. ophthalmologists. Hemorrhagic and thrombotic complications in ophthalmic surgery have

Table 4: Summary of online statements by United States ophthalmologic organizations discussing perioperative use of antithrombotic medications*

Organization	Statement type	Statement topic	Statement summary
AAO	Ask an Ophthalmologist	Intravitreal anti-VEGF injections ¹⁸	No evidence that intravitreal injections to patients on warfarin increases risk of bleeding in the eye
AAO	Ask an Ophthalmologist	Intravitreal anti-VEGF injections ¹⁹	Oral NSAIDs are helpful for pain relief and not contraindicated before intravitreal injections
AAO	Ask an Ophthalmologist	Cataract surgery ²⁰	Cataract surgery can be performed on patients on blood thinners. “Ask (the) ophthalmologist about (specific situations)”
AAO	Ask an Ophthalmologist	Cataract surgery ²¹	Blood thinners are typically not discontinued for cataract surgery, though may be stopped to prevent ecchymoses during anesthetic injections. “(Your) ophthalmologist can discuss (your) particular case”
AAO	Ask an Ophthalmologist	Cataract surgery ²²	Bleeding risk with clopidogrel exists in cataract surgery but is small. “Please discuss your concerns with your cataract surgeon”
AAO	Ask an Ophthalmologist	Laser surgery (unspecified) ²³	Laser surgery likely does not have any effect on coumadin dosing or efficacy
ASOPRS	Educational article	Blepharoplasty and brow ptosis repair ²⁴	Aspirin, NSAIDs, and blood thinners “should be avoided before and after surgery risks or alternatives should be discussed with your surgeon”

*Statements include: Educational articles or “question and answer” statements directed toward patients. AAO: American Academy of Ophthalmology, ASOPRS: American Society of Ophthalmic Plastic and Reconstructive Surgery, VEGF: Vascular endothelial growth factor, NSAID: Nonsteroidal anti-inflammatory drug

resulted in profound medicolegal consequences.^{7,25} In certain situations, failure of the ophthalmologist to properly account for antithrombotic management may result in catastrophic systemic consequences. In 2017, an ophthalmologist was sued following a fatality associated with blepharoplasty surgery.²⁵ In this case, the patient – who was on warfarin – was reported to have informed the surgeon that she had not been able to receive necessary preoperative bridge therapy. The ophthalmologist nonetheless proceeded with the surgery; 2 days later, the patient experienced mesenteric artery thrombosis with acute mesenteric ischemia and subsequently died.

A myriad of U. S. surgical organizations outside the realm of ophthalmology make statements available for physicians on their website regarding perioperative management of antithrombotic medications for their respective surgical specialties.⁸⁻¹⁵ In addition, the American College of Cardiology and American Heart Association provides recommendations regarding the risk-benefit analysis clinicians should perform for patients on aspirin or dual antiplatelet therapy undergoing elective surgery, as do the European Society of Cardiology and European Society of Anesthesiology.^{26,27} Similarly, these organizations provide guidelines regarding management of anticoagulants and dual antiplatelet therapy for elective surgery, and caution that cessation of anticoagulants such as warfarin in circumstances not supported by evidence-based guidelines may worsen patient outcomes. However, while this latter information may be useful in formulation of perioperative planning by ophthalmologists, these guidelines are understandably not specific to ophthalmologic surgeries, and the multitude of different types of surgeries among ophthalmologic subspecialties requires individualized assessments of risks and benefits. Specialty-specific educational material on this matter is warranted, as hemorrhagic concerns may vary widely based on the type of surgery.

Outside of the U. S. ophthalmic organizations have indeed disseminated various educational statements to aid ophthalmologists in such situations. For example, both the Royal College of Ophthalmologists in the U. K. and All India Ophthalmological Society provide recommendations on perioperative use of antithrombotic medications.²⁸⁻³⁰ The Canadian Ophthalmological Society comments on antiplatelet use before cataract surgery, acknowledging that the assessment of bleeding risk may not be straightforward in many cases, but recommending at least that preoperative INR should be within therapeutic range before injection anesthesia or combined procedures.³¹ To date, it is unclear whether the availability of such educational statements has significantly reduced variability in practice patterns by ophthalmologists in these regions – or reduced incidence of lawsuits related to the management of these medications – and further studies are necessary to assess these outcomes.

In addition, certain U. S. surgical organizations outside of ophthalmology not only comment on use of antithrombotics in their respective fields, but also even on the management of ophthalmic patients as well. For example, both the American Academy of Neurology and the American College of Chest Physicians recommend noncessation of antiplatelets before cataract surgery based on their own interpretation of the literature.^{32,33} ASCRS, on the other hand, had no recommendations regarding the use of these medications on their website, despite publishing statements on the use of other medications in cataract surgery such as antibiotics and mydriatic agents.³⁴ It is reasonable to assume that discussions on antithrombotics, if made more available by U. S. ophthalmic organizations, would be of relevance to U. S. ophthalmologists.

Our data demonstrate, however, that the majority of organizational statements regarding the perioperative use of antithrombotics is in fact directed to patients, not physicians. Several patient educational statements suggest that patients

should ask their own ophthalmologist for more definitive advice. This is problematic, as there is a dearth of substantial discussion from U. S. ophthalmologic organizations directed toward ophthalmologists, and though substantial primary literature exists,^{6,35,36} there is little consensus in the literature regarding management. A recent evaluation in the United Kingdom of available literature proposed various management pathway recommendations,⁶ but none, to our knowledge, have been discussed or adopted in statements by U. S. organizations. Of note, commentary articles^{37,38} on perioperative use of antithrombotics have been published by *EyeNet*, a subscription-based magazine published by AAO, though these have not been incorporated or reproduced into official educational statement articles on AAO.org. This may therefore limit the potential audience and these articles do not clearly constitute official statements promulgated by the organization.

This study found that certain organizations provide detailed discussions of perioperative antithrombotic management for cataract surgery – which arguably entails minimal hemorrhagic risk compared to other commonly performed ophthalmic and orbital surgeries. It may therefore be justified to provide a discussion regarding these concerns in other ophthalmic surgical subspecialties. Further, consensus statements on the management of antithrombotics – or at a minimum, acknowledgment, and discussion of the risks and benefits that must be weighed for various ophthalmic surgeries – could help guide practice, protect ophthalmologists from medicolegal consequences, and would be consistent with what other organizations provide for their surgeons.

There were limitations associated with this investigation. A limitation of the analysis of patient-directed statements is that, to a certain degree, these may not truly be considered “statements” disseminated by an organization. Many of the patient-directed statements were indeed presented with a clear disclaimer that such information is for educational purposes only and does not constitute medical advice. Nonetheless, the presence of such information on organizational websites may appear to patients to constitute official information provided by the organization that reflects the organization’s opinion on particular topics, and therefore, evaluation of this information is of importance.

A summary of peer-reviewed literature on perioperative management of these medications was outside the scope of this investigation, as recent comprehensive reviews of this sort – not disseminated under the auspices of U. S. ophthalmologic organizations – have been performed.^{6,35,36}

In summary, a substantial proportion of ophthalmic surgical patients regularly take antithrombotic medications, and excessive perioperative bleeding in ophthalmic surgery, though uncommon, may pose significant risk of morbidity and create medicolegal consequences for their surgeons. Acknowledgment of these risks throughout the many surgical subspecialties, synthesis of the available literature,

and proposal of recommendations to help guide the U. S. ophthalmic surgeon in navigating these challenging cases may therefore be warranted.

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Conflicts of interest

There are no conflicts of interest.

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