Perioperative Medication Management in Elective Plastic Surgery Procedures

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Background: Perioperative medication management is vital to maintain patient safety while under anesthesia, as well as to avoid postoperative complications. Plastic surgeons make daily decisions on whether to ask a patient to stop taking medication before their surgery. These important decisions can affect bleeding risk, wound healing, and interactions with anesthetics, which can range from minor to life-threatening. Current plastic surgery literature lacks a comprehensive review of perioperative medication management, with existing reports focusing on specific procedures and specific medication classes.

Methods: A PubMed database search was conducted for articles through July 2021. The bibliographies of included studies were also examined for articles not acquired in the initial search queries. The authors included studies on medication usage and perioperative guidance in patients undergoing elective plastic surgery procedures. The authors excluded studies unrelated to plastic surgery and studies where the medications were used as an intervention. Abstracts, animal studies, studies involving the pediatric population, and book chapters were also excluded, as well as articles not published in English.

Results: A total of 801 papers were identified by our search terms. After title and abstract screening, 35 papers were selected for full-text review. After full-text review, 20 papers were selected for inclusion, with an additional 6 papers from cited references added. Of the 26 papers, 6 papers discussed psychotropic drugs, 6 papers discussed medications affecting hemostasis, 4 papers discussed hormone-containing medications, 3 papers discussed antilipid medications, 2 papers discussed antihypertensive medications, 2 papers discussed herbal supplements, 1 paper discussed both psychotropic and herbal supplements, 1 paper discussed medications affecting wound healing, and 1 paper discussed rheumatologic medications. A summary of those recommendations was then compiled together.

Conclusions: The perioperative medication management in elective plastic surgery procedures remains a complex and multidisciplinary process. It is important to manage these patients in a case-by-case manner and to consult a specialist when necessary. Careful medication reconciliation is essential to decrease the likelihood of adverse outcomes and interactions with perioperative anesthetics.

Key Words: Elective plastic surgery, medication management, quality improvement

Perioperative medication management is vital to maintaining patient safety while under anesthesia, as well as avoiding postoperative complications and optimizing outcomes. Thus, whether to hold outpatient medications and if so, when to halt and resume them, are paramount decisions made by plastic surgeons on a daily basis. The implications of these medications can affect bleeding risk, wound healing, and interactions with anesthetics, which can range from minor to life-threatening.[1–3] Moreover, adjunctive treatments may be indicated to mitigate the impacts of these medications.

Making informed decisions on perioperative medication management is challenging, as many medications lack outcome data on the consequences of continuation during the perioperative period. This makes management decisions challenging and subjective as reflected by the considerable variability in current medication management.[3,4] Management decisions are driven by surgeon gestalt, as well as general principles, such as whether the medication in question can be stopped and if it has known adverse interactions with anesthetic medications. Furthermore, most decisions are influenced by the type of surgical procedure being performed and the patient's medical history.

Current plastic surgery literature lacks a comprehensive review on perioperative medication management, and available literature largely focuses on specific procedures and medication classes. In addition, new medications that have gained widespread use often postdate the training of many surgeons currently in practice. In this review, we aim to present a comprehensive review of medication management in the perioperative period for elective plastic surgery procedures.

METHODS

A PubMed database search was conducted for articles through July 2021, using the terms listed in Supplemental content, Supplemental Digital Content 1 (http://links.lww.com/SCS/E758). The bibliographies of included studies were examined for articles not acquired in the initial queries. We included studies on medication usage and perioperative guidance in patients undergoing elective plastic surgery procedures. We excluded studies unrelated to plastic surgery and studies where the medications were used as an intervention. Articles not published in English, abstracts, animal studies, studies involving the pediatric population, and book chapters were also excluded.

RESULTS

A total of 801 papers were identified by our search terms. After title and abstract screening, 35 papers were selected for full-text review. After full-text review, 20 papers from the search and 6 papers from associated bibliographies met final inclusion criteria. Of the 26 papers, 6 papers discussed psychotropic drugs, 6 papers discussed

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medications affecting hemostasis, 4 papers discussed hormone-containing medications, 3 papers discussed antilipid medications, 2 papers discussed anti-hypertensive medications, 2 papers discussed herbal supplements, 1 paper discussed both psychotropic and herbal supplements, 1 paper discussed medications affecting wound healing, and 1 paper discussed rheumatologic medications.

DISCUSSION

Antiplatelet/NSAIDs and Anticoagulation Therapy

The American College of Surgeons recommends perioperative anticoagulation be guided by stratification of the patient's thromboembolic risk, along with the procedure's bleeding risk (Supplemental Table 1, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[5] Several studies have provided data to support continuing antiplatelet and anticoagulant therapy in the perioperative period. A double-blind, randomized controlled trial of patients undergoing skin tumor surgery found no difference in bleeding complications in patients taking aspirin versus placebo ($P = 0.107$).[4,6] A review of 9204 facial plastic surgical procedures found similar rates of complications between patients receiving antiplatelet and anticoagulation therapy (aspirin, clopidogrel, bisulfate, and warfarin sodium) in the perioperative period and controls (Supplemental Table 2, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[7] Another review found no observed challenges with intraoperative hemostasis in a cohort of about 40 patients undergoing hand surgery who presented with international normalized ratio between 1.3 and 2.9, without discontinuation of warfarin preoperatively.[8] In a review of antithrombotic therapy in oculofacial surgery, recommendations for when to stop direct oral anticoagulants ranged between 1 and 5 days.[9] In the case of life-threatening bleeding or emergent surgery, the effects of anticoagulation may be reversed by fresh frozen plasma, although the indicatjons for fresh frozen plasma in plastic surgery are very limited.[10] Otherwise, anticoagulants can be discontinued 3 days before surgery as recommended. Similarly, tranexamic acid has been found to benefit patients bleeding due to trauma, but the data may not be applicable to patients routinely taking anticoagulants.[11] Still, there may be benefits of tranexamic acid for patients on anticoagulants with nontraumatic bleeding that have not yet been established and are in need of further study.[11]

Anti-lipid Medications

Statins

The mortality benefit of statins in the perioperative period for patients with dyslipidemia undergoing cardiac, vascular, or general surgery has been established by multiple studies including a meta-analysis on 22,300 patients (12 retrospective and 3 prospective trials).[12–14] Several other studies on patients without dyslipidemia demonstrated that the use of statins in the perioperative period is beneficial because of its anti-inflammatory, antithrombotic, and vasodilatory effects.[15] In addition, it has been hypothesized that these medications can reduce reperfusion injury in patients undergoing free flap surgery.[16] However, the current literature is sparse and lacks adequately powered studies regarding this hypothesis.[16–18] Current recommendations support continuing statins during the perioperative period (Supplemental Table 3, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).

Niacin, Fibrates, and Bile Acid Sequestrants

The risk of myopathy and rhabdomyolysis with niacin and fibrates increases when surgery is performed or when these agents are combined with statins.[19,20] Bile acid sequestrants (cholestyramine and colestipol) can interfere with bowel absorption of multiple medications that may be required perioperatively. Therefore, it would be reasonable to stop these medications a day before the surgery given that the goal of these medications is long-term reduction in cardiovascular morbidity.

Anti-Hypertensive Medications

ACE Inhibitors/ARBs

The perioperative management of angiotensin-converting enzyme inhibitors (ACEI) and angiotensin II receptor blockers (ARBs) is controversial. A large retrospective study on 79,228 patients [9905 (13%) patients on ACEI and 66,620 (87%) patients not on ACEI] undergoing noncardiac surgery, found an increase in transient intraoperative hypotension episodes, but no difference in other intraoperative or postoperative outcomes in ACEI users.[21] Similarly, a meta-analysis done in 2008 demonstrated an increase in patients experiencing hypotension among those who took ACEI or ARBs on the day of the surgery. However, there was no change in important cardiovascular outcomes (ie, death, stroke myocardial infarction, and kidney failure) (Supplemental Table 3, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[21–23]

A retrospective study on patients undergoing tissue-expander insertion or deep inferior epigastric perforator flap reconstruction found that patients treated with ARBs had higher rates of complications, including seroma formation, reconstruction failure, and reoperation in the tissue expander group. In addition, higher rates of necrosis and perfusion-related complications were seen in the deep inferior epigastric perforator flap reconstruction group.[24] Because of the lack of power in this study, further investigation on the topic was recommended to validate these results before clinical application.[25]

The American Heart Association and American College of Cardiology consider continuation of ACEI and ARBs in the perioperative period reasonable. In addition, if ACEI or ARBs are held before surgery, it is appropriate to restart as soon as clinically feasible postoperatively.[26] However, there are contrasting opinions with the Canadian Cardiovascular Society guidelines stating these medications should be withheld for 24 hours before noncardiac surgeries.[27]

Calcium Channel Blockers

The current literature on calcium channel blockers (CCBs) is both limited and conflicting. The only meta-analysis identified recommended the continuation of CCBs in the perioperative period.[28] However, large prospective clinical studies are needed to clarify the impact of CCB use in the perioperative period.[29,30]

Beta Blockers

The safety and cardioprotective effects of beta blockers in the perioperative period have been well established in the literature. Current recommendations are to continue these medications throughout the perioperative period.[31,32]

Diuretics

The perioperative management of diuretics depends on the indication for which a patient is on these medications and on their volume status. Currently, there is no consensus on the perioperative management of diuretics and recommendations remain patient dependent.[33,34]

Rheumatologic Medication

Corticosteroids

Prolonged glucocorticoid use has been associated with a number of surgical complications including increased risk of infection and delayed wound healing. An important consideration is the risk of precipitating adrenal insufficiency requiring stress dose steroids.[35,36] Perioperative guidance depends on the patient's steroid dose. A dose of ≤ 10 mg of prednisone (or equivalent) is reasonable to continue. However, in a patient with a dose of >10 mg of prednisone (or equivalent), elective surgery should preferably be postponed, as a higher dosage often indicates that the underlying disease is not adequately controlled (Supplemental Table 4, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[37,38]

Vitamin A seems to reverse the steroid suppression of TGF-β, thereby stimulating production of fibronectin and collagen, strengthening incisions, and improving wound healing.[38] Considering its benefits in wound care, vitamin A prophylaxis may be recommended to counter the effects of steroids, though limited research exists on the topic.

Nonsteroidal Anti-Inflammatory Drugs

Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used as analgesics and for the treatment of rheumatic diseases, but some plastic surgeons avoid prescribing them because of concerns for perioperative bleeding. A study of 168,990 patients undergoing nasal surgery (septoplasty, rhinoplasty, or inferior turbinate reduction) investigating the impact of NSAIDs on postoperative bleeding found no association between NSAIDs and increased postoperative complications including epistaxis, septal hematoma, emergency room visits, hospital readmission, and 30-day reoperation.[39] Another study investigating the impact of ketorolac tromethamine (Toradol) on hematoma formation in breast surgery concluded that there was no statistically significant difference in hematoma formation due to ketorolac.[40]

Traditional Disease-Modifying Antirheumatic Drugs —(Methotrexate, Leflunomide, Hydroxychloroquine, and/or Sulfasalazine)

Concern surrounding stopping these medications relates to the potential of precipitating flares in the patient's underlying disease, which could impact their postoperative outcomes and rehabilitation.[41,42] The literature states that it is reasonable to continue these medications in the perioperative period, except in patients with known pulmonary, renal, and liver disease when these medications should be withheld 1 week preoperatively.[43,44] Although some animal studies have suggested impaired wound healing because of methotrexate, clinical studies have found no significant adverse effects.[45]

Biological Disease-Modifying Antirheumatic Drugs

The concerns of perioperative management in biological disease-modifying antirheumatic drugs (DMARDs) are similar to that of traditional DMARDs. However, the data are limited with minimal guidance and conflicting recommendations for perioperative management.[43,44] The American College of Rheumatology recommends stopping medications 1 week before surgery and restarting 1 week post surgery.[46,47] Meanwhile, the British Society of Rheumatology recommends stoppage of 3 to 5 half-lives before surgery and resuming once the surgical wounds have begun healing ~2 weeks postoperatively.[48] Although biological DMARDs have historically been found to prolong wound healing, recent literature on the role of anti-TNFα in surgical recovery has been mixed.[49–51] Many biological DMARDs, with the exception of rituximab and abatacept, were found to significantly increase risk of surgical site infections.[49] To account for these findings, each biological DMARD may be evaluated for their specific half-life and risk to the patient (Supplemental Table 4, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).

Colchicine

Surgery is thought to be a trigger for gout attacks, with the incidence of acute gout after surgery being reported as high as 17%. Despite this, the literature regarding perioperative management of gout medication is limited.[52,53] Colchicine has a narrow therapeutic window and patients are at risk of polyneuropathy and myopathy. These risks are exacerbated by renal impairment or if taken in conjunction with other renally excreted medications. Therefore, it is reasonable to hold it on the day of surgery (Supplemental Table 7, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[54]

Psychiatric Medication

Abrupt withdrawal of psychiatric medication is generally not recommended and most of these medications, with some exceptions, should be tapered down before discontinuation (Supplemental Table 5, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[55]

Tricyclic Antidepressant

Decisions regarding the management of TCA medication remain controversial. The main concerns when continuing these drugs are their cardiac side effects (arrhythmias) and interactions with anesthetic agents.[34] Although many anesthesiologists recommend the continuation of these medications, the US Food and Drug Administration recommends discontinuation before elective procedures.[34,55] Therefore, in patients with high risk of cardiac arrhythmias or those with mild depression, TCA can be tapered off over a period of 1 to 2 weeks. Otherwise, it is reasonable to continue these medications (Supplemental Table 5, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[56]

Selective Serotonin Reuptake Inhibitors (SSRI)/ Serotonin Norepinephrine Reuptake Inhibitors (SNRI)

Selective serotonin reuptake inhibitor/serotonin norepinephrine reuptake inhibitor (SSRI/SNRI) have historically been associated with an increased risk of bleeding especially when taken concomitantly with an NSAID or antiplatelet. However, data on this topic are inconsistent. In a study on 392 consecutive patients undergoing cosmetic facial surgery, no statistical association was identified between the use of psychiatric medications such as SSRIs, SNRIs, or TCAs, and increased intraoperative bleeding.[57] However, a different study found that when compared with patients not on these medications, patients using an SSRI were at 4 times greater risk of bleeding when undergoing cosmetic breast surgery, regardless of the type of procedure.[58] Therefore, in low bleeding risk surgeries, it is reasonable to continue the SSRI/SNRI, whereas while in surgeries where bleeding is a concern, the decision to withhold these medication should be weighed against the severity of the underlying psychiatric disorder.[59]

Mood Stabilizing Agents (Lithium)

Lithium must be carefully managed in the perioperative period as it has a narrow therapeutic window with side effects including electrolyte imbalances, nephrogenic diabetes in-

sipidus, and thyroid dysfunction. Current recommendations are conflicting. Of note, if the decision to continue lithium is made, serum lithium and electrolyte levels should be carefully monitored (Supplemental Table 5, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[55]

Antipsychotics

Antipsychotic medications require significant consideration in the perioperative period, as withholding them increases the risk of postoperative psychosis. Moreover, they have a broad safety profile and may interact with anesthetic agents. Therefore, the perioperative management decisions should be made in close collaboration with the psychiatrist and anesthesiologist.

Antiepileptic and Antiparkinsonian medications

Patients with preexisting seizure disorders generally need to continue their medications perioperatively, either parenterally or with small sips of water.[60] When it comes to patients with Parkinson disease, medications should be continued until surgery and resumed as soon as possible. Abrupt withdrawal of these medications should be avoided (Supplemental Table 6, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[61]

Pulmonary Medications

In patients whose underlying disease is well controlled, it is recommended to continue inhaled medications to avoid any perioperative decompensation. Otherwise, it is recommended to consult a pulmonologist before proceeding with the surgery (Supplemental Table 7, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).

Gastrointestinal Medications

The safety profile of these medications has been established and summarized in (Supplemental Table 8, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).

Herbal Supplements

Although less frequently inquired about by providers, herbal supplements can have important clinical consequences. A number of studies in patients undergoing plastic surgery have aimed to assess the prevalence and potential side effects of herbal supplement use. A 2013 study on 200 patients undergoing cosmetic facial surgery found 49% of patients used at least 1 herbal supplement. Of these, 35 patients were taking an herbal supplement and increased bleeding was reported.[62,63] A survey-based study comparing cosmetic plastic surgery patients to the general public found statistically greater herbal supplement usage among cosmetic surgery patients, with 55% of respondents in the cosmetic group reporting herbal supplement use compared with 24% in the general public.[64]

Many herbal supplements are not regulated by the US Food and Drug Administration and thus may not contain the reported quantity, quality, or purity of the active ingredients described on the label.[65] Herbal supplements have a range of potentially dangerous side effects for surgical patients, including effects on heart rate, blood pressure, bleeding, and interactions with anesthetic medications. On the basis of the available data, the American Society of Anesthesiologists recommends patients stop herbal supplements 1 to 2 weeks before surgery. This time frame coincides with the proposed time for most herbal supplements to be cleared by the body (Supplemental Table 9, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).[66]

In addition, clinicians should directly inquire about herbal supplements, as a number of studies have shown that patients are unlikely to report herbal supplement use when asked about current medications.[67,68]

Hormone-Containing Medications

Hormone-containing medications are commonly used as contraceptives, supplementation for age related decline in estrogen, and to address gender dysphoria in transgender and gender expansive patients. The primary hormone-containing medications discussed are hormone-containing contraceptives, hormone replacement medications, selective estrogen receptor modulators (SERMs), and those used in thyroid disease. Estrogen's effect on wound healing is well documented with the evidence of decreased wound healing in postmenopausal women along with improvements after hormone replacement therapy.[69,70] Moreover, in medications containing estrogen or mimicking the action of estrogen, there is a risk of venous thromboembolic (VTE) events.[71,72] Clear guidelines for preoperative medication management of hormone-containing contraceptives, hormone replacements, and SERMs have yet to be established.

Multiple prospective studies and systematic reviews have demonstrated the prothrombotic effects of SERMs leading to increased VTE, specifically deep venous thrombosis, and pulmonary embolism.[73–75] The impact of stopping SERMs preoperatively was assessed in a study of over 800 patients undergoing free flap breast reconstruction and found that cessation of tamoxifen 2 weeks before surgery can decrease the risk of VTE, with similar rates of VTE between patients not taking tamoxifen and those who discontinued tamoxifen 2 weeks before surgery.[76] Interestingly, a more recent but smaller study on free flap breast reconstruction, found similar rates of VTE between patients taking hormonal treatment (SERM or aromatase inhibitor) who stopped medications an average of 8.5 days before surgery and those not taking hormonal therapy.[77]

Estrogen-containing medications, including contraceptives and postmenopausal hormone replacement are known to contribute to an increased VTE risk.[72,78,79] The majority of reports of contraceptive-related VTE investigate oral contraceptive pills as these are the most broadly utilized contraceptive. However, reports have shown increased risk of VTE with other hormone-containing contraceptives. A small case series of 2 patients demonstrated VTE related to the use of hormone-containing vaginal rings after esthetic surgery.[80] The decision to hold estrogen-containing medications should take into account the inherent risk of VTE for the given procedure. Lastly, in patients taking oral contraceptive pills, either recommendation of an alternative form of contraception during the perioperative period or use of thromboprophylaxis is needed (Supplemental Table 10, Supplemental Digital Content 2, http://links.lww.com/SCS/E759).

Limitations

Many medications were not discussed in this manuscript because we aimed to focus this study on medications where no clear consensus had been achieved. In addition, some relevant studies may have been missed because of limitations in search strategy. The studies included had heterogeneous methodologies and results, which limited their generalizability. Despite these limitations, this review highlights important findings related to the perioperative use of many outpatient medications most frequently encountered by plastic surgeons and includes potential considerations and directions for future studies.

CONCLUSIONS

Perioperative medication management in elective plastic surgery procedures remains a complex and multidisciplinary process. It is important to manage these patients on a case-by-case basis while deferring to expert consensus and consulting specialists when necessary. A thorough interview with careful medication reconciliation is essential to decrease the likelihood of adverse outcomes and interactions with perioperative anesthetics.

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