**Anticoagulant Complications in Facial Plastic and Reconstructive Surgery**

Casey T. Kraft, BS; Emily Bellile, MS; Shan R. Baker, MD; Jennifer C. Kim, MD; Jeffrey S. Moyer, MD

**IMPORTANCE** The decision whether to discontinue antiplatelet and/or anticoagulant medications before a facial plastic surgical procedure is a complicated and multifactorial process that involves weighing the risk of perioperative thromboembolic complications with bleeding-related complications.

**OBJECTIVE** To determine the complication rates in patients who undergo a range of facial plastic surgical procedures while receiving antiplatelet and/or anticoagulation therapy.

**DESIGN, SETTING, AND PARTICIPANTS** A total of 9204 surgical procedures from January 1, 2007, through December 31, 2012, at an academic medical center and its affiliated surgical sites were analyzed, with patients who continued receiving antiplatelet and/or anticoagulation (aspirin, clopidogrel bisulphate, and warfarin sodium) therapy during the perioperative period identified and compared with a matched case-control group of patients who did not receive antiplatelet and/or anticoagulation therapy during this period.

**INTERVENTIONS** Facial plastic surgery procedures and perioperative management.

**MAIN OUTCOME AND MEASURES** Complication rates of wound healing (dehiscence or necrosis), infection, bleeding (hematoma or ecchymosis), and return to the operating room.

**RESULTS** Patients who received aspirin therapy at the time of surgery were not more likely to have a complication compared with control patients (odds ratio [95% CI], 0.73 [0.45-1.17]). Patients who received warfarin had increased perioperative bleeding (odds ratio [95% CI], 3.80 [1.15-12.60]) and postoperative infections (odds ratio [95% CI], 7.29 [1.17-45.40]) compared with control patients. Serious complications (flap necrosis, dehiscence, or return to the operating room) were not increased with warfarin use.

**CONCLUSIONS AND RELEVANCE** This study demonstrates that patients who undergo facial plastic surgery may continue taking antiplatelet and/or anticoagulation therapy during the perioperative period safely with minimal serious complications.

**LEVEL OF EVIDENCE** 3.

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Antiplatelet and anticoagulant therapies, such as aspirin, warfarin sodium, and clopidogrel bisulphate, have been in use for decades with the benefit of decreasing the morbidity and mortality associated with thrombosis. With the increased use of cardiac stents and other noninvasive cardiovascular interventions, antiplatelet and anticoagulant therapy continues to grow. Recent surveys have shown that almost one-fifth (19.3%) of the US adult population takes aspirin. Use of these medications is thought by some surgeons to increase the risk of perioperative bleeding and other complications in this patient population. However, there are conflicting data with respect to the true risk of complications; these risks would be expected to differ depending on the procedure performed and the type of antiplatelet, anticoagulant, or combination therapy used. Many surgeons favor discontinuing antiplatelet and/or anticoagulation therapy, particularly when the procedure involves highly vascularized areas, such as the face and nose, where bleeding may adversely affect either functional or anesthetic results. For some patients, discontinuation is not an option owing to the risk of significant perioperative cardiac morbidity or mortality, and surgeons have had to operate on these patients with unclear knowledge of the risks of surgical complications.

This situation has clearly indicated the need to study patients as separate and distinct populations based on the procedures performed. Traditionally, the thought was to discontinue anticoagulant and/or antiplatelet therapy, if possible, before surgery. Several previously published articles on cutaneous surgery, however, have shown that patients who continue therapy do not have worse overall outcomes compared with patients who are not taking anticoagulant and/or antiplatelet therapy despite some increased risk of perioperative bleeding. In contrast, a meta-analysis of more than 1300 patients demonstrated an increased risk of bleeding in relation to the baseline that was associated with moderate (6.6%) and severe (5.7%) complications. However, what is lacking in most studies, to our knowledge, is a consideration of the baseline risk of bleeding and complications in a given patient population. The true risk of bleeding complications after surgery in a population of patients who are receiving antiplatelet and anticoagulation therapy would be the increase in relation to the baseline rate in that population of patients compared with a patient cohort that did not receive antiplatelet and/or anticoagulation therapy but who underwent similar procedures.

In this case-control study, we examined bleeding and associated complications in patients who underwent a range of facial plastic and reconstructive procedures and received antiplatelet and/or anticoagulant therapy during a 6-year period compared with a matched control population that was not given antiplatelet or anticoagulant therapy.

Methods

Institutional review board approval was obtained from University of Michigan (HUM00074141) to study all facial plastic and reconstructive surgical procedures conducted in the operating room for the 3 senior surgeons (S.R.B., J.C.K., and J.S.M.) between January 1, 2007, and December 31, 2012, at the University of Michigan Cancer Center and affiliated surgical sites. This retrospective analysis of 9204 surgical procedures identified 430 procedures in 320 patients for which perioperative antiplatelet and/or anticoagulation were used. Medications were considered withheld if aspirin or clopidogrel had been withheld for more than 7 days or if warfarin was withheld for more than 5 days before surgery per our usual protocol for discontinuation of these medications.

Case-control pairs were chosen from a subset of the 9204 facial plastic surgical procedures in the same time frame that did not have perioperative antiplatelet and/or anticoagulation therapy. Matches were made based on the service date (within 365 days), diagnosis code for surgery, and location of surgery (ambulatory care center, hospital outpatient surgery center, inpatient, or outpatient or observation). Using an “optimal” matching algorithm developed by Bergstralh and colleagues from the Mayo Clinic, we identified 320 matched pairs with data for both a case and a control. These patients were analyzed in an identical manner to the case group, with the same criteria for complication rates used in both groups.

In both the case series and control group, demographic data were compared and analyzed. Preoperative, operative, and postoperative notes were studied for complication rates, designated as wound healing (dehiscence or necrosis), infection, bleeding (hematoma or ecchymosis), and return to the operating room. This study was intended to be as comprehensive as possible, so if the surgeon noted any of these events, it was included regardless of severity. However, complications were also designated as either severe or not severe, considering complete graft loss, dehiscence, or return to the operating room as severe. Comorbidities for each patient were also recorded, focusing on smoking history, diabetes mellitus status, and immunosuppression.

Logistic regression was used to analyze differences in clinical characteristics and complication rates between cases (exposed) and controls (not exposed). A repeated-measures approach was used in the logistic regression models to adjust for the matched nature of the data.

Results

The summary of clinical information for the case and control groups, including sex, comorbidities, and age, are shown in Table 1. In logistic regression models, whether a patient had a complication (any complication) was not found to be associated with sex ($P = .15$), age ($P = .98$), diabetes status ($P = .18$), or smoking ($P = .88$). There was a trend for immunosuppressed individuals to have more complications ($P = .10$).

Table 2 lists the complication rates among cases and controls. Forty-two patients (13.1%) who had taken anticoagulant or antiplatelet medications perioperatively had at least 1 complication recorded, while 5 patients (1.6%) had a severe complication. This outcome is in contrast to patients who were not exposed to anticoagulant or antiplatelet medications perioperatively; 52 of these patients (16.2%) experienced at least 1 complication and 5 patients (1.6%) had a severe complica-
Complication rates were also analyzed based on the individual medication being taken at the time of surgery (Table 3). Patients who took aspirin at the time of surgery were not more likely to have a complication compared with controls (odds ratio [OR] [95% CI], 0.73 [0.45-1.17]). When complication rates

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**Table 1. Clinical Characteristics of Cases and Controls**

<table>
<thead>
<tr>
<th>Clinical Characteristic</th>
<th>Exposed (n = 320)*</th>
<th>Not Exposed (n = 320)*</th>
<th>P Valueb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>72.0 (12.1)</td>
<td>59.4 (14.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>204</td>
<td>147</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Male</td>
<td>116</td>
<td>173</td>
<td></td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>137</td>
<td>189</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>170</td>
<td>212</td>
<td>.001</td>
</tr>
<tr>
<td>Yes</td>
<td>150</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>249</td>
<td>291</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Yes</td>
<td>71</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Surgery type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graft</td>
<td>65</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Local flap</td>
<td>117</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>Interpolated flap</td>
<td>45</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>13</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Other cosmetic</td>
<td>16</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Graft and local</td>
<td>34</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Graft, local, and interpolated</td>
<td>12</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Local and interpolated</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Graft and interpolated</td>
<td>16</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: NE, not estimable.

* Exposed indicates patients who received antiplatelet and/or anticoagulant medications; not exposed, patients who did not.

Values are expressed as number of cases and controls unless otherwise indicated.

b P value from logistic regression model predicting case or control status using logistic regression adjusting for matched-pair correlation structure.

c Not a reliable estimate for P value because of sparse data.

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**Table 2. Complication Rates Among Cases and Controls**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Exposed (n = 320)*</th>
<th>Not Exposed (n = 320)*</th>
<th>P Valueb</th>
<th>P Valuec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>42 (13.1)</td>
<td>52 (16.2)</td>
<td>.28</td>
<td>.30</td>
</tr>
<tr>
<td>Bleeding</td>
<td>13 (4.1)</td>
<td>12 (3.8)</td>
<td>.82</td>
<td>.86</td>
</tr>
<tr>
<td>Wound healing</td>
<td>25 (7.8)</td>
<td>37 (11.6)</td>
<td>.12</td>
<td>.14</td>
</tr>
<tr>
<td>Infection</td>
<td>6 (1.9)</td>
<td>3 (0.9)</td>
<td>.33</td>
<td>.32</td>
</tr>
<tr>
<td>Return to the operating room</td>
<td>3 (0.9)</td>
<td>4 (1.2)</td>
<td>.71</td>
<td>.69</td>
</tr>
<tr>
<td>Severe complication</td>
<td>5 (1.6)</td>
<td>5 (1.6)</td>
<td>&gt;.99</td>
<td>.84</td>
</tr>
</tbody>
</table>

Abbreviation: NE, not estimable.

* Exposed indicates patients who received antiplatelet and/or anticoagulant medications; not exposed, patients who did not.

b P value from repeated measures logistic regression model predicting complication; exposure status is the only covariate in model.

c P value from multivariable repeated measures logistic regression model predicting complication with covariates exposure status, sex, and immunosuppression status.
were examined individually, there were also no differences between patients who took aspirin and those who did not take aspirin perioperatively (Table 3). Patients who took aspirin and clopidogrel also did not have increased complication rates; this finding was also seen in patients who were taking clopidogrel only.

In contrast, patients who were taking warfarin had increased bleeding (OR [95% CI], 3.80 [1.15-12.60]) and postoperative infections (OR [95% CI], 7.29 [1.17-45.40]) compared with patients who were not taking these medications. While none of the patients who were taking warfarin and aspirin had complication rates that reached statistical significance because of the small numbers in this group, there was a strong trend toward more complications in this group. Rates of serious complications (complete graft loss, dehiscence, or return to the operating room) were not significantly increased in patients who were taking warfarin.

Discussion

This study demonstrates that there is an increased risk of adverse events in patients who undergo facial plastic surgery if the patient continues taking warfarin during the perioperative period. Patients who took warfarin were almost 4 times as likely to have a bleeding complication and more than 7 times as likely to have a postoperative infection. The increased postoperative infection rate is consistent with the elevated bleeding rate because hematoma and seromas often become secondarily infected. These findings are consistent with data from a large meta-analysis in which patients who underwent cutaneous surgery while taking warfarin were nearly 7 times as likely to have a moderate to severe postoperative complication compared with controls. Other smaller studies, however, have not shown an increased complication risk with warfarin use.

Aspirin use was not associated with increased complications in our study. This finding is consistent with most publications, which have found that aspirin can be safely continued during the perioperative period with no significant increase in complications in patients who undergo various cutaneous surgical procedures. In contrast, a large prospective study of patients who underwent noncardiac major surgery (intraperitoneal, intrathoracic, retroperitoneal, or major orthopedic) demonstrated an increased risk of major bleeding that required transfusion without an associated decrease in death or nonfatal myocardial infarction when randomized to receive aspirin perioperatively. The use of the other antiplatelet agent, clopidogrel, was not statistically associated with bleeding in our study (OR, 2.57; 95% CI, 0.30-21.71), but there were only 11 patients in this group. Combining aspirin with warfarin or clopidogrel did not demonstrate a statistically significant increase in complications, but there was a strong trend toward adverse outcomes in these patients in our study. The use of multiple antiplatelet and anticoagulant medications has been shown in other studies to result in higher complication rates.

The decision as to whether to discontinue antiplatelet or anticoagulant medications involves an assessment of the qualitative and quantitative risk involved with continuation vs discontinuation of these medications. In our series, the use of warfarin resulted in an increased rate of bleeding and infection, but the incidence of serious complications (flap necrosis, dehiscence, or return to the operating room) was no different than in patients who did not receive anticoagulants. In contrast, there is growing evidence of serious thromboembolic events, including death, when at-risk patients stop taking these medications. While our data would suggest that warfarin use in facial plastic surgery increases complications, the qualitative risk-benefit ratio would seem to favor their continued use given the lack of serious adverse outcomes with their continued use. This is quite a different discussion then telling patients that there is no risk with the continued use of warfarin. Full informed consent should include discussing with patients that bleeding and infection rates are higher when warfarin treatment is continued, and this result could reasonably be assumed to affect the final aesthetic and reconstructive result. Our study was not powered to detect subtle reconstructive differences in patients who had bleeding or infectious complications. However, when these factors are weighed against potential life-threatening complications, prudence would dictate continuation of these agents. This approach is in contrast to aspirin use, for which continued use is likely cardioprotective, and the associated risk of surgical bleeding complications in this population of patients is not higher than in patients who are not taking aspirin.
Conclusions

The treatment of patients who are taking antithrombotic medications is a multidisciplinary effort, but this study demonstrates that cessation of therapy in patients who undergo facial plastic and reconstructive surgery may be done safely with minimal serious complications. Given the prevalence of antithrombotic therapy and the potential for serious life-threatening adverse events, anticoagulant or antiplatelet therapy can be continued in this patient population. Patients who are taking multiple agents should be weaned to a single agent, if possible, given the likely increased risk of complications in this population.

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Author Contributions: Dr Moyer had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Kraft, Moyer.
Acquisition, analysis, or interpretation of data: Kraft, Bellile, Kim, Moyer.

Drafting of the manuscript: Kraft, Moyer.
Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Bellile.
Administrative, technical, or material support: Kraft, Baker, Moyer.

Study supervision: Baker, Kim, Moyer.

Conflict of Interest Disclosures:
None reported.

Additional Contributions: David Hanauer, MD, Department of Pediatrics and Communicable Diseases and Comprehensive Cancer Center Bioinformatics Core, University of Michigan Medical Center, permitted the use of the EMERSE medical record search engine for data acquisition with this study. He did not receive financial compensation.

REFERENCES