Seminars in Cutaneous Medicine and Surgery

Bleeding Complications in Dermatologic Surgery

Eva A. Hurst, MD, Siegrid S. Yu, MD, Roy C. Grekin, MD, and Isaac M. Neuhaus, MD

Although the overall incidence is low, bleeding complications in dermatologic surgery can occur and be the source of significant patient morbidity. In this article, we summarize the key aspects of preoperative assessment of patients at risk for bleeding. A review of current issues and literature regarding safe continuation of anticoagulant and antiplatelet medications in dermatologic surgery patients is also presented. In addition, principles for management of bleeding events, should they occur, are also highlighted.
Semin Cutan Med Surg 26:189-195

KEYWORDS dermatologic surgery, bleeding, hematoma, complications, blood thinners

Despite good clinical judgment and meticulous surgical technique, complications in dermatologic surgery related to bleeding inevitably do occur (Fig. 1). To minimize the clinical sequelae of excessive bleeding, skilled dermatologists anticipate potential difficulties, recognize problems as they arise, and deftly manage hemorrhagic complications. Understanding the key aspects of preoperative assessment, the guidelines for the safe use of blood thinning agents, and steps for management of immediate and delayed bleeding complications are crucial for minimizing patient morbidity and maintaining good surgical outcomes.

Preoperative Assessment: Past Medical History

Careful and directed history taking is the first step in assessing potential risk for bleeding in a patient undergoing a significant dermatologic surgery procedure, such as surgical excision or Mohs micrographic surgery. Common medical problems such as hypertension and anxiety can contribute significantly to bleeding, especially intraoperatively, and every effort should be made to adequately manage these medical problems in the pre- and perioperative periods. History taking should also include medical conditions that can contribute to altered platelet function and coagulation. This includes, but is not limited to, liver disease, renal dysfunction, and both hematologic and solid malignancies. A recent work reports a case of disseminated intravascular coagulation in a patient with metastatic prostate cancer unmasked by Mohs micrographic surgery for a relatively small basal cell carcinoma on the forehead.[1]

Clinicians should specifically assess for any prior history of significant bleeding during low-risk surgical procedures (for example, dental extractions). Previous history of excessive bleeding in this setting may indicate an inherited bleeding disorder such as hemophilia or von Willebrand disease, which is the most common hereditary bleeding disorder. Peterson and Joseph have provided a review on inherited bleeding disorders in dermatologic surgery patients.[2] They emphasize the importance of working in conjunction with an experienced hematologist when dealing with this patient population.

Preoperative Assessment: Medications

Much more common than inherited bleeding disorders are acquired abnormalities in coagulation or platelet function secondary to medications and ingested products. It is well-known that ethanol consumption contributes to bleeding via decreased vasoconstriction and impaired platelet and coagulation function.[2] The use of alternative medicines and therapies has dramatically increased in recent years, and it has been reported that 22% of presurgical patients take various herbs and that 51% consume vitamin supplements.[3] Until recently, vitamins and herbal supplements often were overlooked in the preoperative history. Patients, especially women, often do not readily reveal their alternative medications to their physicians. A recent report found that more than 35% of patients on alternative therapies did not inform their doctor.[4] A Spanish anesthesiology study found that 89% of patients consuming herbal plant products did not consider them to be a medication, and that 91% would not

UCSF Dermatologic Surgery and Laser Center, San Francisco, CA.
This article was previously published in Semin Cutan Med Surg 26:40-46, 2007.

1085-5629/07/$-see front matter
doi:10.1016/j.sder.2008.03.002

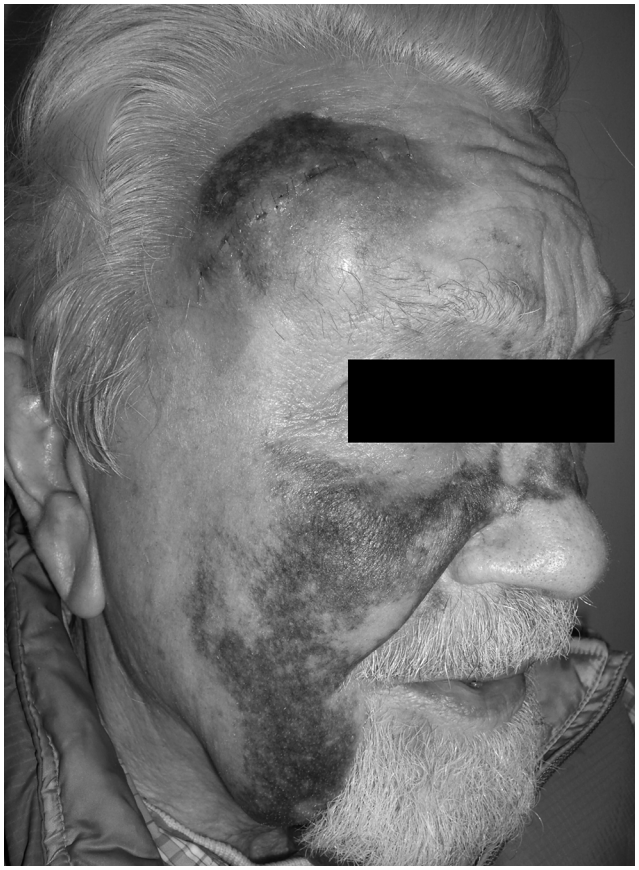

Figure 1 Postoperative hematoma and large ecchymoses 1 week after Mohs surgery. (Color version of figure is available online.)

have told an anesthesiologist about them on routine interview.[5] Dinehart and Henry recently published an excellent comprehensive review on dietary supplements and altered bleeding and coagulation.[6] They report that many dietary supplements can alter coagulation and platelet function, with many effects on platelets being irreversible. Therefore, the recommendation is for patients to stay off all vitamins and supplements for 7 to 10 days before surgery. The exceptions are vitamin E and ginkgo, which can be discontinued several days before surgery.[6]

Although most patients can easily discontinue their alternative therapies in the perioperative period, discontinuation of nonsteroidal antiinflammatory drugs (NSAIDs) or anticoagulant and antiplatelet medications such as warfarin and aspirin is a much more complex issue that continues to be debated among dermatologic surgeons. A large percentage of patients are on NSAIDs for musculoskeletal and other pain syndromes. A significant proportion of the U.S. population takes aspirin for primary prevention of cardiac and cerebrovascular events, with primary prevention being defined as treatment aimed at preventing vascular events in patients who currently have no evidence of vascular disease. Furthermore, a variety of anticoagulants and blood-thinning agents currently are used in patients as secondary prevention for thromboembolic events. Secondary preventative efforts focus on identifying and treating those with established disease, or those at very high risk for developing thromboembolic disease. Common indications for secondary prevention include patients with artificial heart valves or valvular heart disease, history of stroke or myocardial infarction, atrial fibrillation, underlying coagulopathies, and a history of pulmonary embolism and/or deep venous thrombosis.[7] Table 1 summarizes the currently used antiplatelet and antithrombotic agents, with brief explanations of their mechanisms of action.[8]

Considerations Regarding Perioperative Continuation of Blood-Thinning Agents

The decision of whether or not to discontinue anticoagulant therapy in patients with significant thromboembolic risk, as outlined previously, has been subject to significant study and debate in dermatologic surgery, especially during the past decade. The deliberations center on balancing the possible increased risk of bleeding and hemorrhage with the low, but potentially life-threatening, risk of a thrombotic event if anticoagulant therapy is temporarily discontinued. The vast majority of published literature involves the use of warfarin and aspirin. Other blood thinning agents are not well studied.

To provide guidelines regarding anticoagulant use in dermatologic surgery, several factors need to be taken into consideration

- What is the overall rate of hemorrhagic complications in dermatologic surgery?
- Is the risk of hemorrhagic complications in patients taking blood thinning agents higher than this overall risk?
- Does temporary perioperative discontinuation of blood-thinning agents significantly decrease the risk of hemorrhagic complications?
- Are there objectively measurable adverse operative effects of warfarin and aspirin?
- What is the risk of thromboembolic events after temporary perioperative discontinuation of blood thinning agents?
- What is the relative magnitude of bleeding versus thrombotic complications?

Baseline Risk of Bleeding Complications

The baseline risk of hemorrhagic complications in dermatologic surgery has been estimated to be less than 2% by several authors. In 2003, a prospective study investigating immediate and delayed dermatologic surgery complications demonstrated an overall complication rate of 1.64%. The majority of these complications (postoperative hemorrhage, hematoma formation, flap or graft necrosis, wound dehiscence, infection) were either directly or indirectly related to problems with hemostasis.[9] In this series, none of the patients required hospitalization or the assistance of another specialist. This demonstrated 1.64% rate of complications is comparable to

Table 1 Blood-Thinning Agents and Their Mechanisms of Action

Class	Subclass/Mechanism	Chemical (Brand) Name
Antiplatelet	Blocks formation of thromboxane A2 via inhibition of cyclooxygenase	Aspirin
	Inhibitors of ADP-induced activation of platelets	Ticlopidine hydrochloride (Ticlid)
		Clopidogrel (Plavix)
	Glycoprotein IIb/IIIa inhibitors (block platelet adhesion)	Abciximab (Reopro)
		Eptifibatide (Integrilin)
		Tirofiban hydrochloride (Aggrastat)
Antithrombin	Unfractionated heparin (binds antithrombin III and rapidly inactivates coagulation enzymes)	Heparin
	Direct thrombin inhibitors	Hirudin (Refludan)
		Agatroban (Novastan)
	Low molecular weight heparins (similar mechanism to unfractionated heparin)	Enoxaparin sodium (Lovenox)
	Coumarins (antagonists of Vitamin K which decrease Vitamin K dependent clotting factors II, VII, IX, X, and Protein C and S	Warfarin (Coumadin)
Thrombolytic	Plasminogen activators (activate plasminogen and hence cause fibrinolysis)	Streptokinase (Streptase)
		Alteplase (tPA)

Adapted from Alam M, Goldberg L. Serious adverse vascular events associated with perioperative interruption of antiplatelet and anticoagulant therapy. Dermatol Surg 2002;28:992-998.[8]

two additional reports estimating 2% rates of significant hemorrhage or hematoma in control patients undergoing dermatologic surgical procedures in the absence of blood thinning agents.[10,11]

Risk of Bleeding in Patients Continuing Blood-Thinning Agents

Numerous studies have compared the rate of hemorrhagic complications in patients on versus off of blood-thinning agents. A review of these published reports reveals the near-unanimous conclusion that there is no increased risk of severe hemorrhagic complications in anticoagulated patients. Furthermore, the literature suggests that perioperative discontinuation of anticoagulants does not decrease the risk of bleeding complications. Several of these studies even focused specifically on Mohs surgical procedures, during which difficulties with hemostasis would have been tested by increased defect size, extensive undermining, and relatively more complex repair methods. Sufficient data exist to support that blood-thinning agents may be safely continued in dermatologic surgery without exposing the patient to a significant increase in risk for bleeding complications. These studies are summarized in Table 2 and are detailed further herein.

The largest prospective study regarding anticoagulant use in dermatologic surgery was published by Billingsley and Maloney in 1997.[11] The authors reported no significant increase in severe adverse events in Mohs micrographic surgery patients on blood thinning agents (12 patients on warfarin and 97 on either aspirin or NSAIDs) compared with controls. There was also no significant difference between these groups in the complexity of repair performed. Thirty-three percent of the aspirin/NSAID group and 8% in the warfarin group underwent flaps or grafts, compared with 34% in the control group. The only statistically significant finding noted was that 5/12 (42%) of warfarin patients had "excessive intraoperative bleeding," defined as excessive if

Table 2 Summary of Studies Examining the Incidence of Dermatologic Surgical Complications in Patients on Blood Thinners

Drug and Study	No. of Patients	Controlled Study	Increased Severe Complications*
Aspirin and NSAIDs			
Otley et al[10]	286	Yes, retrospective	No
Billingsley & Maloney[11]	97	Yes, prospective	No
Lawrence et al[20]	61	Yes, prospective	No
Bartlett[17]	52	Yes, prospective	No
Shalom and Wong[16]	41	Yes, prospective	No
Kargi et al[18]	37	Yes, prospective	No
Warfarin			
Otley et al[10]	26	Yes, retrospective	No
Billingsley & Maloney[11]	12	Yes, prospective	No
Lam et al[14]	13	Yes	No
Alcalay[12,13]	16	Yes, prospective	No
Kargi et al[18]	21	Yes, prospective	Yes
Syed et al[15]	47	Yes, prospective	No

*Excessive bleeding (>1 hr despite pressure), hematoma, flap/graft necrosis, wound dehiscence, or infection.

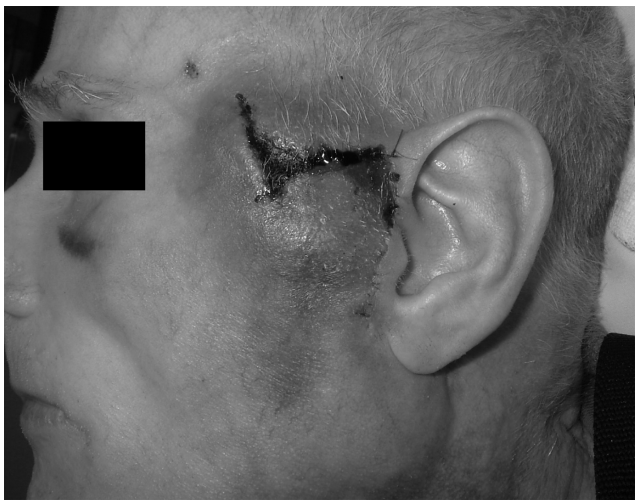

Figure 2 Hematoma in an aspirin-taking patient who underwent a large transposition flap repair following Mohs surgery for squamous cell carcinoma. (Color version of figure is available online.)

the time required to achieve hemostasis at the time of closure was greater than 3 minutes.[11]

A large retrospective study of warfarin, aspirin, and NSAID use in cutaneous surgery patients was published by Otley and coworkers in 1996.[10] In this study, incidence of severe complications were reported for 653 patients undergoing Mohs surgical and excisional surgical procedures. Severe complications were defined as significant intraoperative or postoperative hemorrhage, wound bleeding greater than 1 hour and not stopped with pressure, acute hematoma, necrosis of flap or graft, or dehiscence greater than 2 mm. Of the 26 patients who continued warfarin, one experienced a severe complication, compared with 1 severe event in the 101 patients in whom warfarin was held. Similarly, 4 severe events were reported in the 286 patients continuing aspirin or NSAIDs compared with 3 of the 240 patients who discontinued these medications perioperatively. On the basis of these results, Otley and coworkers concluded that continuation of warfarin or platelet inhibitors is associated with a very low risk of severe complications and that the rate of complications is not statistically significantly increased compared with patients in whom the same medications are discontinued. It is worth noting that only 54 (8%) of the 653 patients underwent flap or graft repairs, with two out of the five severe events in patients on warfarin or blood thinners occurring in these more complex repairs (Fig. 2).[10]

Other smaller prospective studies have also supported the safety of blood thinning agents in cutaneous surgical procedures. Alcalay and Alkalay reported no significant adverse events in 68 consecutive patients undergoing Mohs micrographic surgery while on warfarin.[12,13] Similarly, Lam and coworkers found no difference in adverse events in a small group of dermatologic surgery patients continuing warfarin therapy vs those treated with heparin perioperatively as recommended by Goldsmith and coworkers in 1993.[14] The most recently published study addressing warfarin was by Syed and coworkers in 2004.[15] In this prospective study of 47 patients, nine experienced only minor bleeding, with no major adverse events noted. However three of the nine were noted to have an intraoperative international normalized ration (INR) of 3.5 or greater. Of note, only 5 of 47 patients had intraoperative INR's of 3.5 or greater, with 60% of those experiencing the minor bleeding episodes.[15] This was the first study to directly address INR values and attempt to correlate with bleeding complications in cutaneous surgery patients taking warfarin.

Shalom and Wong recently reported only a statistically increased incidence of intraoperative suture ligation for hemostasis (and no significant bleeding events) in 41 patients on aspirin compared with 212 controls undergoing excisions of cutaneous and subcutaneous lesions.[16] Finally, Barlett reported no increased incidence of minor, severe, or overall bleeding complications in 52 patients undergoing minor dermatologic surgery while on aspirin compared with 119 patients who were not taking aspirin.[17]

Only one group has published data suggesting significantly increased major bleeding complications in patient undergoing minor cutaneous surgery while on warfarin.[18] Of 21 patients on warfarin, 5 (24%) experienced a major bleeding complication, which was defined as persistent bleeding, wound hematoma, loss of skin graft, or wound infection. This number was significantly higher than that in the 37 patients on aspirin and the 44 controls. This study did not report on INR values or monitoring on the warfarin treated patients. There was no significant difference between the aspirin and control groups with regards to bleeding complications.[18]

Although multiple studies in the dermatologic surgery literature have addressed NSAID, aspirin, and warfarin use, there are currently no published reports addressing bleeding complications in patient on clopidogrel (Plavix®, Bristol-Myers Squibb). Clopidogrel is a selective inhibitor of platelet adhesion to fibrinogen and aggregation via inhibition of ADP-induced platelet activation. Its use continues to increase as a component of secondary prevention among cardiac and cerebrovascular patients, and it is often used in combination with aspirin. The only published study regarding clopidogrel and bleeding complications is in the pulmonary literature. A 2006 prospective cohort report found that clopidogrel significantly increased the bleeding risk in patients undergoing transbronchial biopsy, with the effect exacerbated by concomitant aspirin use.[19] As this agent continues to be utilized in more patients, studies regarding its effects on dermatologic surgery complications will be beneficial.

Potential Objective Measurements to Predict Intraoperative Bleeding in Patients on Blood Thinners

Lawrence and coworkers showed that both aspirin and NSAIDs can significantly increase bleeding time in dermatologic surgery patients.[20] This increase uncommonly goes beyond normal range, with only approximately 25% (8/40) of

aspirin-treated and 10% (1/21) of NSAID-treated patients having measurably abnormal bleeding times. No significant increase in adverse events in 61 patients on either aspirin or NSAIDs was detected in this study. However, the 3 patients who experienced excessive intraoperative bleeding were all taking aspirin and did have abnormal bleeding times.

It is known that INR values greater than 5 can result in severe and significant bleeding, and Syed and coworkers found that 60% of patients with intraoperative INRs greater then 3.5 had a bleeding event.[15] We recently had a patient experience a major bleeding event 1 week after an excision and repair of a large cancer on the chest due to an unstable INR which went from therapeutic values to greater than six in the postoperative period. Optimal timing of preoperative INR measurement will vary case-by-case, but an INR at least within 1 week of surgery is recommended.

Despite the belief by many surgeons that they can predict anticoagulant or blood thinner status intraoperatively, a recent study shows that physicians at all levels of training were equally unable to assess blood thinner status based on visual inspection of intraoperative oozing.[21] This is similar to findings reported in coronary artery bypass patients, in which surgeons' impressions of aspirin status were unreliable.[22]

Adverse Events Related to Blood-Thinning Agent Discontinuation

There are now documented reports of serious thromboembolic events occurring in patients who discontinued warfarin or aspirin therapy for dermatologic surgery. Kovich recently reported data from a survey of 504 members of the American College of Mohs Micrographic Surgery and Cutaneous Oncology.[23] One hundred sixty-eight respondents reported 46 patients who experienced thrombotic events. These were all serious events and included 24 strokes, 3 cerebral emboli, 5 myocardial infarctions, 8 transient ischemic attacks, 3 deep venous thromboses, 2 pulmonary emboli, and 1 retinal artery occlusion leading to blindness. Three deaths were reported. Of the 46 patients who experienced thrombotic events, 54% had an event when warfarin was held, 39% occurred when aspirin was held, and 4% of events happened when both medications were held.[23] There are other documented case reports in the dermatologic surgery literature of stroke, pulmonary embolus, and clotted prosthetic valve occurring in patients in whom anticoagulation or antiplatelet medications were discontinued perioperatively.[24,25] A review in the *New England Journal of Medicine* highlights the potential gravity of thromboembolic complications. A patient who experiences a recurrent episode of venous thromboembolism has a 6% mortality risk, and 2% risk for serious permanent disability. Arterial thromboembolism morbidity and mortality rates are higher, with 20% of events being fatal and 40% resulting in serious permanent disability.[26]

For 2 of the common indications for warfarin (atrial fibrillation and artificial heart valve replacement), the estimated risks of thromboembolism are 1% to 20% per year and 8% to 22% per year, respectively.[27] For the third most common indication, deep venous thrombosis (DVT), the estimated clotting risk is 1% per day for patients who have had a DVT within 1 month, and 0.2% and 0.04% for patients with DVTs within 2 to 3 months and more than 3 months, respectively. Using these numbers, the estimated 2-day risk of a thrombotic event in a patient taken off warfarin for a dermatologic procedure is 0.01% to 0.3% in the setting of atrial fibrillation and 0.08% to 0.4% for a patient with an artificial heart valve replacement. For DVT patients, the 2-day risk is 4% to 6% in those less than 1 month after a DVT, 0.8% to 1.2% in those 2 to 3 months after DVT, and 0.16% to 0.24% in those more than 3 months after DVT.[27]

In addition to a patient's own hypercoagulable risk due to underlying conditions, there is a theoretical risk of rebound hypercoagulation in patients who discontinue warfarin perioperatively. This is believed to be due to levels of vitamin K-dependent clotting factors regenerating at different rates. For example, pro-coagulant factors VII and IX usually return to normal faster than anticoagulant Proteins C and S. This risk is thought to be highest during the first week after stopping warfarin, and is not reflected by traditional measurements of anticoagulation such as prothrombin time (PT), international normalized ration (INR), or partial thromboplastin time (PTT).[25]

Current Surgical Practice Managing Perioperative Blood-Thinning Agents

A 2002 survey of members of the American College of Mohs Micrographic Surgery and Cutaneous Oncology revealed that 80% of surgeons sometimes or always discontinue warfarin perioperatively and that cutaneous surgeons discontinue aspirin in 26% of cases, even if medically necessary.[28] Although the survey was retrospective with only a 50% response rate, it suggests that many dermatologic surgeons still feel that warfarin and aspirin use significantly adversely affects dermatologic surgery outcomes. This study highlights the current need for continued evidence-based research on this topic in dermatologic surgery, as well as the benefit of specific recommendations which can be implemented in daily practice.

Recommendations Regarding Perioperative Use of Blood-Thinning Agents

All vitamin supplements and herbal medications should be discontinued 10 to 14 days preoperatively and resumed 1 week after surgery. For practical purposes and because many supplements and over-the-counter vitamins can affect bleeding, we do not distinguish between various agents with regards to recommending patient discontinuation.

Nonsteroidal antiinflammatory medications (NSAIDs) should be stopped 3 days before surgery, with recommended resumption 1 week after the procedure. Because of their re-

versible effect on platelet aggregation via cyclooxygenase inhibition and the relatively short drug half-life, 3 days of preoperative discontinuation is sufficient for resumption of platelet function, and we find that most patients can tolerate being off NSAIDs for that period of time. Primary preventative aspirin, which irreversibly inhibits platelet function, should be discontinued 10 to 14 days before surgery, and re-started one week after the procedure.

Medically necessary warfarin and aspirin should be continued, with an INR value recommended within at least 1 week of surgery. Care must be taken to assess in the preoperative history whether or not the warfarin doses and INR measurements are stable. In addition, a careful medication history assessing for new medication additions that may affect warfarin levels is crucial.

We currently recommend that patients continue clopidogrel in the perioperative period, although further studies regarding this medication and complications are warranted.

As with clopidogrel, there is no current data in the dermatologic surgery literature with regards to newer anticoagulant medications such as low molecular weight heparin, and these patients should currently be evaluated on an individual basis in conjunction with their primary care physician or cardiovascular specialist.

Management of Bleeding Complications

Despite optimal perioperative patient management, meticulous surgical technique, and attentive hemostasis, hemorrhagic complications will still occasionally occur. The dermatologist should be well versed in anticipating potential difficulties, recognizing problems as they arise, and deftly managing the complications. Management should be tailored to the severity of the event, and whether the complication is immediate (intraoperative) or delayed (postoperative).

Intraoperative oozing and excessive bleeding is often easily controlled with meticulous electrodesiccation/electrocoagulation and suture ligation of larger vessels. To prevent hematoma formation, a drain placement is sometimes necessary for persistent diffuse oozing at the time of reconstruction. Postoperative bleeding and/or oozing can often be controlled by patient-applied pressure and ice, and this is always recommended as a first step. Most significant hematomas will form in the first 24 to 72 hours after surgery. If aggressive application of direct pressure is inadequate in alleviating postoperative bleeding and there is a concern for hematoma formation, re-evaluation is indicated. Acute or subacute and nonloculated hematomas should be evacuated through the smallest possible opening of the wound, and any active bleeding treated (Fig. 3). Packing and/or drain placement should be attempted, and prophylactic antiobiotics should be instituted as infection is a common complication of hematoma. Rarely, we have found reversal of anticoagulation with fresh frozen plasma on an inpatient basis necessary to control diffuse bleeding in a patient on warfarin with a supra-therapeutic INR.

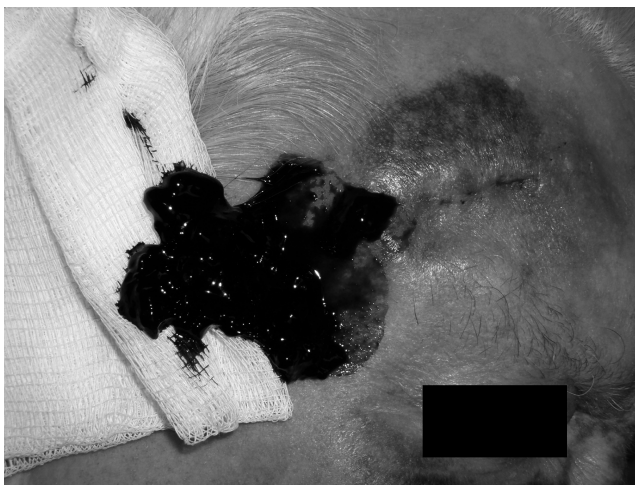

Figure 3 Evacuation of a large hematoma through a small lateral wound opening. (Color version of figure is available online.)

Summary

Although the overall complications rate in outpatient cutaneous surgery is low, the majority of complications are either directly or indirectly related to bleeding. The first step in minimizing the occurrence of bleeding complications is careful preoperative history taking. It is imperative to assess a patient's medical status before any significant dermatologic surgical procedure. Careful medication history, with direct questions regarding herbals and supplements, is absolutely necessary. All vitamins and supplements, nonnecessary NSAID use (which encompasses most NSAID takers) and preventative aspirin use should be discontinued in the perioperative period.

Reports in the dermatologic surgery literature support perioperative continuation of medically necessary and secondary preventative aspirin and warfarin. Multiple studies have failed to show an increase in serious adverse events related to the continuation of these agents during dermatologic surgery procedures. In addition, discontinuation of necessary aspirin and warfarin has been associated with adverse thromboembolic events. While uncommon, these events are often severe, and potentially fatal. The dermatologic surgery data correlates with that published in other specialties including dentistry, urology, and ophthalmology, in which continuation of blood thinners throughout the perioperative period is advised. In these surgical specialties, continuation of blood thinning agents is practiced for numerous procedures including dental extractions, transurethral prostatectomy, and cataract surgery.[29-30] On the basis of currently available data, we recommend all medically necessary and secondary preventative aspirin, warfarin, and clopidogrel be continued perioperatively in dermatologic surgery patients. We advocate an INR measurement in warfarin-taking patients within at least one week of surgery.

Other than the article by Billingsley and Maloney,[10] most currently published reports specify small numbers of patients on anticoagulants and blood thinners undergoing complex

flap or graft repairs. Therefore, data are more limited with regards to bleeding complications in these patients and consideration of anticoagulant and blood thinner status is recommended when designing reconstructions. Simpler reconstructions and minimal undermining should be considered when feasible and appropriate in these patients. Further consideration should also be given to highly vascular sites where hemostasis can be difficult to control, such as the scalp and scrotum. Certainly, meticulous hemostasis and postoperative pressure dressings are a crucial component of all dermatologic surgery procedures.

The reviewed studies and recommendations presented herein are applicable primarily to necessary dermatologic surgery procedures, mostly in treating skin cancers. Extreme care should be taken on a case-by-case basis when considering these issues before a cosmetic surgical procedure. The effects of bleeding and/or hematoma can significantly alter a cosmetic outcome and it is our opinion that necessary anticoagulants or antiplatelet drugs are a contraindication to major cosmetic dermatologic surgery procedures such as (but not limited to) liposuction, hair transplantation, face-lifts, and blepharoplasties. In addition, careful counseling regarding bruising and bleeding risk should be detailed in patients on blood thinning agents who wish to undergo minor cosmetic procedures such as filler placement.

References

1. Guldbakke KK, Schanbacher CF: Disseminated intravascular coagulation unmasked by Mohs micrographic surgery. Dermatol Surg 32:760-764, 2006
2. Peterson SR, Joseph AK: Inherited bleeding disorders in dermatologic surgery. Dermatol Surg 27:885-889, 2001
3. Tsen LC, Segal S, Pothier M, et al: Alternative medicine use in presurgical patients. Anesthesiology 35:226-227, 2000
4. Barraco D, Valencia G, Riba AL, et al: Complementary and alternative medicine (CAM) use patterns and disclosure to physicians in acute coronary syndromes patients. Complement Ther Med 13:34-40, 2005
5. Valencia Orgaz O, Orts Castro A, Castells Armenter MV, et al: Assessing preoperative use of medicinal plants during preanesthetic interviews. Rev Esp Anestesiol Reanim 52:453-458, 2005
6. Dinehart SM, Henry L: Dietary supplements: Altered coagulation and effects on bruising. Dermatol Surg 31:819-826, 2005
7. Schanbacher CF: Anticoagulants and blood thinners during cutaneous surgery: Always, sometimes or never? Skin Therapy Lett 9:5-8, 2004
8. Goldsmith SM, Leshin B, Owen J: Management of patients taking anticoagulants and platelet inhibitors prior to dermatologic surgery. J Dermatol Surg Oncol 19:578-581, 1993
9. Cook JL, Perone JB: A prospective evaluation of the incidence of complications associated with Mohs micrographic surgery. Arch Dermatol 139:143-152, 2003
10. Otley CC, Fewkes JL, Frank W, et al: Complications of cutaneous surgery in patients who are taking warfarin, aspirin, or nonsteroidal anti-inflammatory drugs. Arch Dermatol 132:161-166, 1996
11. Billingsley EM, Maloney ME: Intraoperative and postoperative bleeding problems in patients taking warfarin, aspirin, and nonsteroidal anti-inflammatory agents. Dermatol Surg 23:381-385, 1997
12. Alcalay J, Alkalay R: Controversies in perioperative management of blood thinners in dermatologic surgery: Continue or discontinue? Dermatol Surg 30:1091-1094, 2004
13. Alcalay J: Cutaneous surgery in patients receiving warfarin therapy. Dermatol Surg 27:756-758, 2001
14. Lam J, Lim J, Clark J, et al: Warfarin and cutaneous surgery: A preliminary prospective study. Br J Plast Surg 52:372-373, 2001
15. Syed S, Adams BB, Liao W, et al: A prospective assessment of bleeding and international normalized ratio in warfarin-anticoagulated patients having cutaneous surgery. J Am Acad Dermatol 51:955-957, 2004
16. Shalom A, Wong L: Outcome of aspirin use during excision of cutaneous lesions. Ann Plast Surg 50:296-298, 200
17. Bartlett GR: Does aspirin affect the outcome of minor cutaneous surgery? Br J Plast Surg 52:214-216, 1999
18. Kargi E, Babuccu O, Hosnuter M, et al: Complications of minor cutaneous surgery in patients under anticoagulant treatment. Aesth Plast Surg 26:483-485, 2002
19. Ernst A, Eberhardt R, Wahidi M, et al: Effect of routine clopidogrel use on bleeding complications after transbronchial biopsy in humans. Chest 129:734-737, 2006
20. Lawrence C, Sakuntabhai A, Tiling-Grosse S: Effect of aspirin and nonsteroidal anti-inflammatory drug therapy on bleeding complications in dermatologic surgical patients. J Am Acad Dermatol 31:988-992, 1994
21. West SW, Otely CC, Nguyen TH, et al: Cutaneous surgeons cannot predict blood-thinner status by intraoperative visual inspection. Plast Reconstr Surg 110:98-103, 2002
22. Kallis P, Tooze JA, Talbot S, et al: Pre-operative aspirin decreases platelet aggregation and increases post-operative blood loss: A prospective, randomized, placebo controlled, double-blind clinical trial in 100 patients with chronic stable angina. Eur J Cardiothorac Surg 8:404-409, 1994
23. Kovich O, Oltey CC: Thrombotic complications related to discontinuation of warfarin and aspirin therapy perioperatively for cutaneous operation. J Am Acad Dermatol 48:233-237, 2003
24. Alam M, Goldberg LH: Serious adverse vascular events associated with perioperative interruption of antiplatelet and anticoagulant therapy. Dermatol Surg 28:992-998, 2002
25. Schanbacher CF, Bennett RG: Postoperative stroke after stopping warfarin for cutaneous surgery. Dermatol Surg 26:785-789, 2000
26. Kearon C, Hirsh J: Management of anticoagulation before and after elective surgery. N Engl J Med 336:1506-1511, 1997
27. Spandorfer J: The management of anticoagulation before and after procedures. Med Clin North Am 85:1109-1116, 2001
28. Kovich O, Otley CC: Perioperative management of anticoagulants and platelet inhibitors for cutaneous surgery: A survey of current practice. Dermatol Surg 28:513-517, 2002
29. Alexander R, Ferretti AC, Sorensen JR: Stop the nonsense not the anticoagulants: A matter of life and death. N Y State Dent J 68:24-26, 2002
30. Campbell JH, Alvarado F, Murray RH: Anticoagulation and minor oral surgery: Should the anticoagulation be altered? J Oral Maxillofac Surg 58:131-135, 2000