Preventing and managing complications in dermatologic surgery: Procedural and postsurgical concerns

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Learning objectives
After completing this learning activity, participants should be able to identify proper application of electrosurgery to minimize and avoid risks to the patient and health care providers; describe and apply optimal post-surgical wound care to optimize would healing; distinguish and manage wound dehiscence, and hematoma formation, and surgical site infections to improve outcomes; and identify patients who may experience post-operative pain and describe how to manage these patients.

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The second article in this continuing medical education series reviews the evidence regarding the intraoperative and postoperative risks for patients and health care workers. We share the most up-to-date recommendations for risk management and postoperative complication management to ensure optimal surgical efficacy and patient safety. (J Am Acad Dermatol 2021;84:895-903.)

Key words: dermatologic surgery; electrosurgery; hematoma; pain management; postsurgical infection; wound care; wound dehiscence.

ELECTROSURGERY RISKS

Key points

- Although electrosurgery risk in patients with cardiac implantable devices is low, the risk can be mitigated by using bipolar forceps or electrocautery
- Surgeons should use bipolar electrodes no closer to the device than 1 cm for noncardiac implantable devices
- Risks to the surgeon should be managed with surgical masks and smoke evacuation

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For patients with a pacemaker or implantable cardioverter-defibrillator (ICD), there is a question regarding whether the electrosurgical current may cause electromagnetic interference that can affect cardiac device function.[1,2] While shielding technology helps insulate cardiac devices from external electromagnetic currents, understanding how to mitigate patient risk can help prevent complications such as inhibition of the pulse generator, pacemaker reprogramming, battery depletion, profound bradycardia or asystole, defibrillator deactivation, or direct myocardial stimulation causing arrhythmia or tissue injury.[1,3-5]

In dermatologic surgery, the overall risk of complications to ICDs is low, with few reported events.[5,6] Theoretically, patients with cardiac devices should undergo a preoperative cardiology consultation to confirm the device type and patients' dependence on its function as well as postoperative device interrogation.[1,7] However, likely because of the low rates of reported complications, few dermatologists follow through with these recommendations.[8]

General precautions in patients with a pacemaker or ICD include 1) using bipolar forceps or electrocautery and avoiding unipolar cautery when possible; 2) using short energy bursts <5 seconds in duration; 3) maintaining low power settings; 4) avoiding use within 15 cm of ICD/pacemakers because of the risk of direct device damage; 5) avoiding cutting current; and 6) directing the current pathway away from the device with assistance of a grounding plate.[1,3,5,7,9,10] If a non–low-risk device modality is used, resuscitation support in the form of trained personnel, equipment, and medications should be available.[1] There is controversy regarding whether magnet application should be used to program pacemaker devices to a fixed-rate mode, especially in patients undergoing procedures above the umbilicus.[11,12] For patients with an ICD, magnets should not be used without clearance from a cardiologist or the manufacturer of the device because of the risk of reprogramming and deactivation.[7]

For noncardiac electrical implantable devices, such as cochlear implants, the recommendation is to use only bipolar electrodes no closer to the implant than 1 cm to avoid electrode heating, electrical shock, and device dysfunction.[7] Data on deep brain stimulators in dermatologic surgery are more limited, but bipolar forceps or a monopolar device with appropriate dispersive electrode placement is recommended.[4,7]

Other electrosurgical risks include fire and smoke inhalation by the physician, other health care providers, and the patient. Flammable materials, such as towels or drapes, gauze, isopropyl alcohol, aluminum chloride, hairspray, and diethyl ether, should not be in close proximity—particularly when using monopolar devices, which are the most common source of fires in Mohs micrographic surgery (MMS).[13]

Smoke plumes from electrosurgery can expose dermatologists and team members to carcinogenic, infectious, and pulmonary risks. Specifically, smoke plumes may contain high concentrations of viruses including HIV/human papillomavirus in patients with those viruses, carcinogens including chemical acrylonitrile and benzene with mutagenic potential, and dead and live cellular materials.[14-16] One large survey study found that only 10% of dermatologic surgeons use smoke management practices.[16,17] The lack of awareness of surgical smoke risk and the low practice of preventative measures has also been shown in trainees.[18] Air contaminants from the surgical plume can be controlled with smoke evacuation equipment, positioning the nozzle within 1 cm of the surgical site, and with the use of high-filtration surgical masks, such as a laser mask, an N95 mask, or a respirator approved by the National Institute for Occupational Safety and Health.[14,18,19]

POSTSURGICAL WOUND CARE

Key points

- Newer evidence suggests that topical silicone gel may have greater efficacy than petrolatum
- Biologic dressings may have advantages over conventional autografts in properly selected patients

The ideal wound dressing helps achieve hemostasis, protect against infection and foreign material, limit tissue movement, provide a moist environment, lessen mechanical trauma, and remove exudate.[20] Conventional wound dressings consist of layered components using ointment as well as nonadherent, absorbent, contouring, or compressive material.[20] Topical petrolatum has typically been preferred. Topical antibiotics have no benefit in infection prophylaxis for clean excision wounds. They can cause antimicrobial resistance and contact allergy, and studies have shown their overuse in routine excisions.[21-23] There is evidence suggesting that topical silicone may be more efficacious than petrolatum as a postoperative ointment. In contrast to petrolatum, silicone gel is nonocclusive, waterproof, gas permeable, and has antimicrobial properties.[24] In addition, it has been shown to reduce inflammation and scar formation.[24] Beyond hydration and healing, ointments also prevent adhesion of the dressing to the wound, facilitating removal.[20]

Postoperative acute secondary intention wounds may benefit from occlusive or semiocclusive wound

dressings for optimal healing because they prevent desiccation and infection and can be associated with faster healing times.[20,24,25] Children may especially benefit from wound re-enforcement with short adhesive strips over sutures, stretch bandage wraps, or balaclava-like head dressings.[26] For special site considerations, liquid bandages have demonstrated safety and efficacy for sutured facial excisions, bone wax has demonstrated success in the concha, and zinc oxide compression dressings can be used for leg excisions.[27-29]

MMS often results in large defects, and the use of skin substitutes offers an alternative to large flaps or autografts or secondary intention healing for the right wound in the right patient.[30] The goal of skin substitutes in the acute postoperative period is to provide matrix, cells, and other healing materials as a scaffold for host tissue integration and revascularization; they are generally biodegradable. Skin substitutes can be epidermal, dermal (cellular or acellular), or composite (epidermal and dermal) as well as synthetic or biologic.[20] These dressings offer advantages over conventional autografts in avoiding donor site creation, reducing autologous skin graft thickness, decreasing pain, reducing number of required dressing changes, covering the surface of a large defect, and decreasing healing times.

Epidermal autografts are not frequently used for postoperative wounds because they are friable, associated with a high risk of infection and poor graft uptake, and take many weeks to cultivate.[20] Dermal grafts applied directly to the wound can stimulate healing. Bovine and porcine acellular dermal xenografts can be useful for deep wounds with exposed bone, tendon, or cartilage providing an opportunity for soft tissue bulk/dermal regeneration before repair.[30] Cellular dermal allografts stimulate extracellular matrix to produce wound healing proteins but can stimulate a robust immunogenic host response.[31] A cellular dermal allograft known as Dermagraft (Organogenesis) has been used successfully for intraoral defects.[32] Composite grafts have been engineered as skin equivalents. Apligraf (Organogenesis) is one such graft that provides analgesia, ease of wound care, and good outcomes in the acute postoperative setting. Compared with secondary intention healing, Apligraf has been associated with improved cosmesis and fewer vascular scars in full-thickness MMS defects.[33]

WOUND DEHISCENCE

Key points

- Increased tension, infection, hematoma, smoking, and increased age all increase the risk of wound dehiscence
- Clean, dehisced wounds can be managed with resuturing

Wound dehiscence is estimated to occur in 8% of dermatologic surgery cases.[34,35] Risk factors for dehiscence include increased age, anatomic sites under increased tension, infection, hematoma formation, smoking, and the use of vascular endothelial growth factor inhibitors or oral tyrosine kinase inhibitors.[34,36-41] Choice of closure modality (sutures vs. adhesives vs. staples) does not significantly impact dehiscence risk.[42,43]

Although dehiscence can occur at any time, it most commonly occurs within approximately 2 weeks postprocedure, when scar tensile strength is at 10% of normal. If the wound is clean and without signs of infection or hematoma, the surgeon should consider resuturing. While cutaneous surgical literature on this topic is limited, surgical debridement and primary closure were shown to significantly decrease healing time compared with secondary intention healing for dehisced sternotomy wounds (12.2 vs. 29.7 days).[44] There is no clear consensus on whether wounds should be freshened with excision or debridement before resuturing because of the concern that this may remove active fibroblasts and decrease tensile strength, as opposed to applying new sutures directly to dehisced wound edges.[34,45,46] There is also no clear consensus regarding length of time after dehiscence that resuturing is a viable option. Justiniano and Eisen[46] noted acceptable outcomes in a group of patients whose wounds were resutured at an average time of approximately 5 days after dehiscence. Resuturing after 3 to 5 days postdehiscence is often less successful in the authors' experience. Friable tissue often cannot hold deep buried sutures. In such cases the wound can be closed with simple sutures.[46] Placement of Steri-Strip closures (3M) is an alternative to sutures in dehisced wounds for patients who wish to avoid needles, although patients should be counseled that healing times may be slower, the scar may be wider, and there may be premature release of the Steri-Strip closures.[45,47] Dehiscence caused by infection or hematoma should be appropriately treated before repeat closure is considered.

HEMATOMA MANAGEMENT

Key points

- Hematomas are rare dermatologic surgical complications
- Treatment can include aspiration with a large-bore needle or opening the wound for evacuation

and possible vascular ligation if an expanding hematoma is present

Postoperative hematoma formation is rare, reported in 0.1% to 2.4% of dermatologic surgical cases. Flap and graft reconstruction are at higher risk.[48-52] In the published plastic surgery literature, hypertension is considered a risk factor, with studies showing reduced risk with good intraoperative and postoperative blood pressure control.[53,54] It may therefore be worth obtaining a blood pressure reading postoperatively in patients with hypertension who require more significant reconstructions.[55] Large-scale studies from other specialties have identified risk factors including male sex, preoperative bleeding diathesis, multiple procedures, preoperative anticoagulant use, preoperative anemia, low body mass index, and ≥4 comorbidities.[56-58] Significant hematomas can be prevented with meticulous hemostasis, pressure dressings, and closing dead space.[59]

To avoid infection, depending on size, hematomas can be treated with aspiration with a large-bore (16-18 gauge) needle within 48 hours of formation versus opening the surgical wound with evacuation and irrigation if after 48 hours of formation.[50,60] A hematoma enters the liquefactive stage after 7 to 10 days. At this point, it is appropriate to treat with needle aspiration.[61] After evacuation, if residual bleeding is controlled and the surgical site is dry, the wound may be repaired with attention to closing dead space. Many providers will start antibiotics empirically to prevent infection. For an actively expanding hematoma, the wound should be partially or fully opened to allow for ligation or cautery of the culprit vessel.[61] In such cases, providers have anecdotally suggested numbing with lidocaine without epinephrine during wound opening and evacuation for ease in finding the bleeding source. In cases of recurrent capillary ooze for patients on antithrombotics, the use of fibrin sealants containing fibrinogen and thrombin may be helpful and are commonly used by plastic surgeons to prevent hematoma formation after facelift.[62,63]

SURGICAL SITE INFECTIONS

Key points

- Surgical site infections are exceedingly rare
- Postoperative antibiotic prophylaxis is not routinely recommended

Dermatologic surgery has an extremely low infection risk, estimated to be between 0.4% and 2.5%.[64] The most common timeframe for surgical site infections (SSIs) is between 4 and 10 days postoperatively. The formal definition for SSI by the US Centers for Disease Control and Prevention is an infection only involving the skin and subcutaneous tissue occurring within 30 days postoperatively.[65] At least 1 of the following is also required for diagnosis: 1) purulent drainage from the incision site; 2) organism isolation from a culture of incisional fluid or tissue; 3) tenderness or localized swelling with warmth and erythema; or 4) a clinical diagnosis of SSI by the physician.[65] SSI is considered a national performance measure for MMS safety.[66]

Endogenous host risk factors in dermatologic surgery include diabetes, smoking, a body mass index >25 kg/m^2, anatomic site, preoperative contamination, anticoagulation therapy, preoperative hypoalbuminemia, nasal *Staphylococcus aureus* carriage, and age (risk steadily increases with age).[67-73] Immunosuppression does not appear to be a significant risk factor.[74] Other SSI risk factors reported in the literature include the lack of sterile draping, operation duration >24 minutes, type of reconstruction with flaps and grafts, excision size >2 cm, hemostasis issues, and healing by secondary intention.[69,75-78] Stringent surgical attire or the use of electrocautery over scalpel have not been shown to decrease the risk of SSI.[79-83]

Brewer et al[84] published a large meta-analysis examining 11,071 patients who underwent outpatient surgical procedures including laceration repair, MMS, simple excisions, and tooth extractions. There was no significant difference in likelihood of developing SSI when providers used sterile versus nonsterile gloves.[84] Topical antibiotics are not generally recommended for clean excision wounds because their use has not been shown to decrease SSI incidence but is associated with contact dermatitis.[21-23] However, providers should consider topical antibiotics for wounds left to heal by secondary intention because one large Cochrane review did show relative SSI risk reduction with topical antibiotics (relative risk 0.61 [95% confidence interval 0.42-0.87]).[85] There may be other circumstances in which providers may prescribe topical antibiotics, such as poor personal hygiene or for specific sites such as the lower legs in patients with diabetes or sites in close proximity to the nasal mucosa, but there is currently a lack of published studies to support routine use in these cases. Early dressing removal with normal bathing 12 hours postsurgery versus delayed dressing change with regular bathing after 48 hours does not affect the risk of SSI.[86,87]

Routine postoperative oral antimicrobial use has not shown robust benefit in SSI prevention and is not recommended.[22,64,88] Although *S aureus*

colonization has been associated with risk for SSI, routine presurgical swabbing would be impractical, unnecessarily burdensome, and costly. For patients known to be colonized with *S aureus*, presurgical topical decolonization with intranasal mupirocin and chlorhexidine gluconate bodywash are associated with decreased SSI incidence as opposed to perioperative oral antibiotic use.[89]

If SSI occurs, wound cultures can be obtained. However, empirical antibiotic coverage against *S aureus* and *Streptococcus pyogenes* with cephalosporins is often first-line treatment unless patients are at high risk for methicillin-resistant *S aureus*—in these cases, first-line options include doxycycline, clindamycin, or trimethoprim-sulfamethoxazole.[90]

POSTOPERATIVE PAIN MANAGEMENT

Key points

- Nonsteroidal anti-inflammatory drugs and acetaminophen should be used for first-line postoperative analgesia
- Short-term opioid medication strength and treatment duration should be limited and carefully monitored to prevent dependency

Most patients experience little postoperative pain after MMS and standard excisions. The day of surgery is associated with the greatest postoperative pain. One study found that pain after MMS dropped significantly by postoperative day 4, which should guide prescription habits. Increased postoperative pain is associated with preoperative anxiety, multiple lesions treated at once, surgical sites involving the lip, forehead, scalp, genitalia, nail, chest, leg, and nose, and flaps or grafts.[91-93] Secondary intention healing is associated with less postoperative pain.[93] Nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen as monotherapy or in combination are recommended as first-line postoperative analgesia.

NSAID risks include gastric mucosal erosion, renal impairment, and cardiovascular events even with short-term use in patients who are at high risk.[94] Aspirin specifically increases bleeding time.[94] Thus, the risk—benefit ratio should be evaluated carefully, particularly for large excisions, flaps, and grafts where sufficient evidence for NSAID use is limited.[94] NSAIDs are not recommended in patients with cirrhosis because of increased gastrointestinal bleeding and renal dysfunction.[95] Acetaminophen is widely used for analgesia after minor procedures and is particularly useful for patients with NSAID allergy, peptic ulcers, renal impairment, and aspirin intolerance.[96,97] Lower dosages are recommended for patients with liver disease, anorexia, or alcohol intake of >3 drinks daily.[97]

There is a limit to therapeutic efficacy for both NSAIDs and acetaminophen.[94] Short-term opioids and tramadol can be considered second-line options for moderate to severe pain. There is no clear evidence to determine the scenarios in which opioids rather than nonopioid pain medications should be considered postoperatively. Opioids act directly on the mu receptors in the central nervous system to produce analgesic effects, which vary highly between patients.[94,97] Adverse effects include nausea, constipation, and respiratory depression, as well as chronic dependence and addiction.[94,98,99] If prescribing opioids, providers may concomitantly want to suggest use of a stool softener to avoid constipation.

Persistent opioid use after minor nondermatologic surgery is commonly reported, with preoperative pain or behavioral disorders being strongly associated.[100] Opioids are not often used in the setting of dermatologic surgery. Those who do use them may take few pills and are then left with remaining pills.[93,101] Opioids should be ordered at the lowest strength and shortest duration possible; the quantity prescribed should be controlled to prevent dependence or prevent use of remaining pills by others.[92,102] In a prospective study of patients undergoing cutaneous procedures, the majority did not require opioids; of those who did, 36 hours of treatment was sufficient.[103]

Gabapentin increases gamma-aminobutyric acid to modulate pain. Its supplementary use can reduce opioid requirements.[104] Common adverse effects include dizziness and sedation.[97] Tramadol has multiple mechanisms of analgesia, some of which act through the opioid receptor. Advantages over opioids include decreased respiratory depression, decreased gastrointestinal effects, and decreased central nervous system driven dependence and addiction.[99]

In one Cochrane review, the addition of codeine to acetaminophen only increased the proportion of patients with ≥50% pain relief from 10% to 15%.[105] In addition, the use of tramadol monotherapy postoperatively showed 97% control rates through postoperative day 4 after MMS.[106] In one double-blind randomized controlled trial, patients immediately post-MMS were given acetaminophen alone, acetaminophen with ibuprofen, or acetaminophen and codeine, with 1000 mg acetaminophen combined with 400 mg ibuprofen every 4 hours providing the most efficacious postoperative pain control.[96] In totality, studies recommend minimizing opioids for pain relief in dermatologic surgery. Dual therapy

with acetaminophen and ibuprofen should be considered first-line for patients at risk for increased pain, with monotherapy appropriate for routine procedures.

CONCLUSION

The intraoperative setting poses risks that are important to recognize and mitigate appropriately. Proper postoperative wound dressings, pain management, and patient counseling regarding wound care can help prevent wound dehiscence, SSI, poor pain control, and opioid dependence. The dermatologic surgeon must be able to manage the postoperative complications of dehiscence and hematoma formation. Such complications can be prevented or managed effectively to promote good surgical outcomes.

Conflicts of interest

None disclosed.

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Answers to CME examination

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