Evidence-based clinical practice guideline: Reconstruction after skin cancer resection

Andrew Chen, MD, John G. Albertini, MD, Jeremy S. Bordeaux, MD, MPH, Michael W. Chen, MD, Jonathan L. Cook, MD, Caryn Davidson, MS, Katelyn C. Donnelly, MPH, Irfan I. Galaria, MD, MBA, Catherine M. Hannan, MD, Jonathan Kantor, MD, MSCE, Daniel L. Kapp, MD, Naomi Lawrence, MD, Clifford W. Lober, MD, JD, Lauren D. Loeding, MPH, Alexander Miller, MD, Daniel T. Ness, MD, Rogerio I. Neves, MD, PhD, Peter C. Revenaugh, MD, Peter Setabutr, MD, Sunil S. Tholpady, MD, PhD, Travis T. Tollefson, MD, MPH, Marta J. Van Beek, MD, MPH, Paul R. Weiss, MD, and Murad Alam, MD, MSCI, MBA

Farmington, Connecticut; Winston-Salem, Durham, and Gastonia, North Carolina; Cleveland, Ohio; Walnut Creek, Irvine, and Sacramento, California; Arlington Heights and Chicago, Illinois; Chantilly, Virginia; Washington, DC; St. Augustine, West Palm Beach, Tampa, and Orlando, Florida; Philadelphia and Hershey, Pennsylvania; Marlton, New Jersey; Indianapolis, Indiana; Iowa City, Iowa; and New York, New York

A multi-disciplinary work group involving stakeholders from various backgrounds and societies was convened to develop guidelines for the management of reconstruction after skin cancer resection. The goal was to identify areas of common ground and provide evidence-based recommendations to improve patient care. Given the heterogeneity of reconstructive techniques and clinical scenarios, investigation centered around common elements in the process. In some cases, a distinction was made between treatment options in the office-based setting as opposed to those in the facility setting. A systematic literature review was performed, and an established appraisal process was used to rate the quality of relevant scientific research (Grading of Recommendations Assessment, Development, and Evaluation methodology). Final recommendations are related to concepts concerning the timing of reconstruction, management of anticoagulation, use of antibiotics, methods of pain control, and follow-up assessment. At times, there was insufficient evidence to make high-level recommendations. The literature analysis highlights the need for additional methodologically robust studies in this area, to help guide clinical practice. (J Am Acad Dermatol 2021;85:423-41.)

From the University of Connecticut; The Skin Surgery Center; University Hospitals Cleveland Medical Center/Case Western Reserve University; Kaiser Permanente; Duke University Medical Center; American Society of Plastic Surgeons; Galaria Plastic Surgery and Dermatology; Veterans Affairs Medical Center; Florida Center for Dermatology; Department of Dermatology, University of Pennsylvania Perelman School of Medicine; private practice; Cooper Medical Center, Rowan University; University of South Florida; University of Central Florida; University of California, Irvine; Piedmont Plastic Surgery and Dermatology; Pennsylvania State University; Rush University Medical Center; University of Illinois at Chicago; R. L. Roudebush Veterans Affairs Medical Center; University of California, Davis, Medical Center; University of Iowa Hospitals & Clinics; private practice; and Northwestern University.

Disclosure: This clinical practice guideline was funded by the American Society of Plastic Surgeons with support from the American Society for Dermatologic Surgery; no outside commercial funding was received to support the development of this document. Each organization paid travel expenses for members to attend face-to-face meetings. For detailed disclosures for each author, see the Disclosure Appendix at the end of this article.

This article has been co-published with permission in the Plastic and Reconstructive Surgery, Dermatologic Surgery, and the Journal of the American Academy of Dermatology.

Accepted for publication October 27, 2020.

Correspondence to: Andrew Chen, MD, Division of Plastic Surgery, University of Connecticut, 263 Farmington Avenue, Farmington, CT, 06030. E-mail: drandrewchen1@gmail.com.

Published online April 27, 2021.

0190-9622/$36.00

https://doi.org/10.1016/j.jaad.2021.03.015

According to the American Cancer Society, skin cancer is the most common type of human cancer, with one in five Americans diagnosed by the time they are 70 years old.[1] Between 1994 and 2014, the diagnosis and treatment of nonmelanoma skin cancers in the United States rose 77 percent.[2] A variety of methods may be used in the treatment of skin cancer, and surgical resection is often performed. Surgical reconstruction is frequently recommended as part of the therapeutic approach. Final wound defect appearance, morphology, and anatomic location, as well as patient history and preferences, may influence the type of repair chosen.[3,4] Reconstructive options may include tissue rearrangement, grafts, or flaps. The reconstruction may be performed by the same individual performing the resection or by a different qualified health care professional. The aim of this guideline is to focus on the process of surgical reconstruction after skin cancer resection.

SCOPE AND INTENDED USERS

In order to avoid confusion and arrive at a consensus, the scope of the guideline begins with the process of reconstruction, assuming that the skin cancer is resected and the margins are clear of tumor. As the guideline is intended to inform the practice of reconstruction, issues relating to the resection (i.e., methods, margins, and so on) are outside the scope of this effort and may be addressed by other publications about skin cancer treatment. Reconstruction is defined as cutaneous closure that requires a flap, graft, or tissue rearrangement. Secondary intention healing, simple closures, and complex closures (where no flaps or grafts are needed or where muscle or bone are involved) are outside the scope of this guideline.

This guideline provides evidence-based recommendations for surgical reconstruction after resection of skin cancer once clear margins have been achieved. The work group did not specify who should perform the reconstructive surgery but assumes that the surgeon planning this procedure will be capable and qualified.

This evidence-based guideline is supported by a systematic review of evidence and specifically addresses surgical timing, use of antibiotics, pain control, and management of anticoagulants for patients undergoing reconstruction after removal of skin cancer. This guideline is intended to be used by the multidisciplinary team that provides care for patients with skin cancer requiring reconstruction. Health care practitioners should evaluate each case individually, while considering these evidence-based recommendations along with patient values and preferences, to determine the optimal treatment plan for each patient. This guideline is intended to serve as a resource for health care practitioners and developers of clinical practice guidelines and recommendations.

DISCLAIMER

Evidence-based guidelines are strategies for patient management, developed to assist physicians in clinical decision-making. This guideline was developed through a comprehensive review of the scientific literature and consideration of relevant clinical experience, and it describes a range of generally acceptable approaches to diagnosis, management, and prevention of specific diseases or conditions. This guideline attempts to define principles of practice that should generally meet the needs of most patients in most circumstances.

This guideline should not be construed as a rule, however, nor should it be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed at obtaining the appropriate results. It is anticipated that it will be necessary to approach some patients' needs in different ways. The ultimate judgment regarding the care of a particular patient must be made by the physician in light of all the circumstances presented by the patient, the available diagnostic and treatment options, and the available resources.

This guideline is not intended to define or serve as a standard of medical care. Standards of medical care are determined on the basis of all the facts or circumstances involved in an individual case and are subject to change as scientific knowledge and technology advance and as practice patterns evolve. The recommendations in this guideline reflect the state of current knowledge at the time of publication. Given the inevitable changes in the state of scientific information and technology, this guideline will be considered relevant for a period of 5 years after publication, in accordance with the inclusion criteria of the ECRI Guidelines Trust.

METHODS

For the full, detailed methodology, **see Appendix A, Supplemental Digital Content 1**, available on www.jaad.org.

Work Group Selection Process

This guideline is a joint effort of the American Society of Plastic Surgeons (ASPS), American Society for Dermatologic Surgery (ASDS), American Academy of Dermatology (AAD), American Academy of Facial Plastic and Reconstructive Surgery (AAFPRS), American Academy of Otolaryngology—Head and

Neck Surgery Foundation (AAO-HNSF), American College of Mohs Surgery (ACMS), American Society for Mohs Surgery (ASMS), and American Society of Ophthalmic Plastic and Reconstructive Surgery (ASOPRS). The ASPS and ASDS each provided a co-chair to coordinate the process.

All applicants were required to submit an online conflict-of-interest disclosure form, and the co-chairs were free of all conflicts of interest for the duration of the project, as required by policy.

Clinical Question Development

Work group members used a consensus-based approach to select the seven clinical questions to be addressed in this evidence-based guideline.

Literature Search

Multiple literature searches were performed between 2017 and 2018 to identify relevant studies published from 1990 to 2018 in all relevant databases using appropriate combinations of MEDLINE Medical Subject Headings (MeSH) terms and keywords, as permitted by the search functionalities of each database or journal.

Critical Appraisal of Evidence

A modified version of the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) process was used to evaluate the methodologic quality of clinical studies and the strength of clinical evidence. A total of 9836 references were identified from databases, with 8696 screened after duplicate records were excluded. After screening and critical appraisal were performed, 20 studies were selected for final review for this guideline.

Grading of Recommendations

Clinical practice recommendations were developed using BRIDGE-Wiz software[5] (Building Recommendations In a Developer's Guideline Editor; Yale Center for Medical Informatics, New Haven, Conn.) during an in-person meeting in the spring of 2018. The recommendations were refined during subsequent conference calls and online discussions. Each recommendation in this guideline is accompanied by a grade indicating the strength of the recommendation, which was determined by considering the overall level of evidence supporting the recommendation and the judgment of the guideline developers. See Fig 1 and Table 1 for a definition of the level of evidence and strength of recommendation.

Peer Review and Public Comment Process

The draft guideline was peer reviewed by the ASPS, ASDS, ASMS, AAO-HNS, American Society of Clinical Oncology, and American Society for Radiation Oncology using the Appraisal of Guidelines for Research and Evaluation Global Rating Scale (AGREE-GRS) instrument.

Guideline Approval Process

The final guideline was approved by the ASPS Executive Committee in February of 2019, the AAD and ASMS Board of Directors in April of 2019, and the AAO-HNS Executive Committee in May of 2019. Per the project Memorandum of Understanding, the guideline was approved by all remaining parties in late April of 2019.

Plan for Updating Guideline

The guideline will be updated within 5 years or in the event that newly published evidence may result in a change to current recommendations. The ASPS uses a digital platform (Presentation and Evaluation of Evidence-based Research, or P.E.E.R.) to store literature and data, thereby facilitating an efficient updating process.

RECOMMENDATIONS

A summary of recommendation statements is shown in Table 2.

Recommendation 1: The work group finds that it is acceptable that clinicians perform reconstructive surgery in a delayed (asynchronous) fashion for adult patients after skin cancer resection.

Evidence Quality: Low

Recommendation Strength: Option

Recommendation 1: Rationale (Table 3)

Reconstruction can be performed immediately following excision of a skin cancer, or reconstruction can be delayed until days, weeks, or even months later.[6-14] At least three studies of low to moderate quality have compared immediate to delayed reconstruction for relative functional and aesthetic outcomes.[6-8] A low-quality study found that a 1-month interval before reconstruction improved survival of grafts of the foot,[6] but a moderate-quality study of grafts at various anatomic locations detected no reduction in partial graft necrosis when reconstruction was delayed 1 to 8 days.[8] A comparative study of delayed versus immediate nasal reconstruction that stratified graft repairs in terms of degree of graft loss reported a higher rate of loss in some, but not all, categories of grafts placed immediately versus 12 to 14 days later.[7] The same study found that waiting to perform reconstruction reduced nasal valve

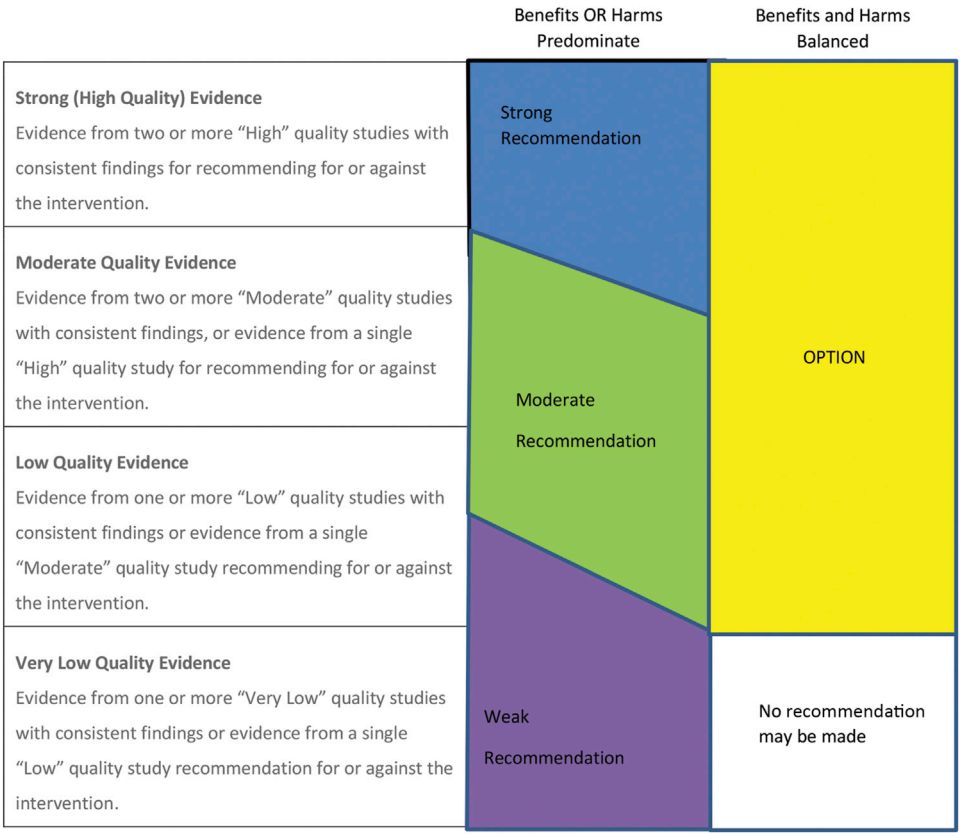

Fig 1. ASPS strength of aggregate evidence and recommendations.

Table 1. ASPS Recommendation Definitions and Levels of Adherence

	Definition	Level of Adherence
Strong recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and quality of evidence is excellent (moderate or strong) or unobtainable.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Moderate recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and the quality of evidence is good but not excellent (or is unobtainable).	Clinicians would be prudent to follow a moderate recommendation but should remain alert to new information and sensitive to patient preferences.
Weak recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), but the quality of evidence is low or very low.	Clinicians would be prudent to follow a weak recommendation but should remain alert to new information and very sensitive to patient preferences.
Option	An option is provided when the aggregated data show evidence of both benefit and harm that appear similar in magnitude for any available courses of action.	Clinicians should consider the options in their decision-making, but patient preference may have a substantial role.

impairment, wound contractures, and depressions at the graft site. A number of noncomparative studies have separately assessed the outcomes of either immediate reconstructions or delayed reconstructions.[11-14] In general, rates of surgical complications have not been found to be different. Minor infections were seen in 4 percent to 8 percent of patients in the delayed and immediate repair cohorts.[10,11,13] Wound dehiscence, significant bleeding requiring hospitalization, and rates of deep vein thrombosis, pulmonary embolus, and myocardial infarction were not reported after immediate reconstruction.[10,11] Flap

Table 2. Recommendation Statements for Reconstruction after Skin Cancer Resection

Recommendation	Level of Evidence	Assessment of Benefits/ Harms	Strength of Recommendation	References
1. The work group finds that it is acceptable that clinicians perform reconstructive surgery in a delayed (asynchronous) fashion for adult patients after skin cancer resection.	Low	Benefits and harms are balanced	Option	6-14
2. The work group suggests that clinicians should not routinely prescribe systemic antibiotic therapy in the interim between resection and reconstruction for adult patients undergoing reconstruction after skin cancer resection.	Low	Preponderance of benefit over harm	Weak	15,16
3a. The work group suggests that clinicians may administer perioperative (i.e., no more than 24 hours before surgery) systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in a *facility* (*non—office-based*) setting	Low	Preponderance of benefit over harm	Weak	17
3b. The work group recommends that clinicians should not routinely administer perioperative systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in the office-based setting.	Moderate	Preponderance of benefit over harm	Moderate	15,17
4a. The work group recommends that clinicians should continue anticoagulant, antithrombotic, and antiplatelet medications for adult patients undergoing reconstruction after skin cancer resection in the office-based setting.	Moderate	Preponderance of benefit over harm	Moderate	22-27
4b. The work group recommends that clinicians should coordinate with the physician managing the anticoagulation medication before modifying the medication prior to reconstruction procedures in a *facility* (*non—office-based*) setting.	N/A	Preponderance of benefit over harm	N/A (good practice recommendation)	N/A
5a. The work group recommends that clinicians should not routinely prescribe narcotic medication as first-line treatment for pain in adult patients undergoing reconstruction after skin cancer resection.	Moderate	Preponderance of benefit over harm	Moderate	41
5b. The work group recommends that clinicians should prescribe acetaminophen and nonsteroidal anti-inflammatory drugs as first-line therapy in adult patients undergoing reconstruction for skin cancer resection.	Moderate	Preponderance of benefit over harm	Moderate	41
6. The work group suggests that clinicians discuss management of pain, antibiotics, and anticlotting agents with adult patients undergoing reconstruction after skin cancer resection when relevant.	N/A	Preponderance of benefit over harm	N/A (good practice recommendation)	N/A
7. The work group suggests that clinicians may offer postoperative follow-up assessment to adult patients undergoing reconstruction after skin cancer resection.	N/A	Preponderance of benefit over harm	N/A (good practice recommendation)	N/A

N/A, Not applicable.

Table 3. Recommendation 1

Recommendation 1	The work group finds that it is acceptable that clinicians perform reconstructive surgery in a delayed (asynchronous) fashion for adult patients after skin cancer resection.
Evidence quality	Low
Recommendation strength	Option
Benefits	• Patients with anxiety can be managed and sent for general anesthesia. • There is time for patients to process reconstructive options. • Surgical reconstruction requiring general anesthesia will require the patient to fast before surgery, whereas this is not required at the time of a typical Mohs surgical resection. • Delayed reconstruction allows planning and improves outcomes for specific procedures, as in delayed grafts for cartilage resection. • Local anesthetic dose is minimized. • Clinician is able to bring in surgeon with more reconstructive expertise in complicated cases; it is easier to coordinate scheduling. • There is a lower risk of physician and patient fatigue.
Risks, harms, and costs	• Patients may have some anxiety at leaving wound open. • Patient may be inconvenienced. • It is possible the patient may need to manage dressing. • Cost of multiple surgeons involved may be greater. • There is a possible greater risk of bleeding complications at home. • There is a risk of contracture and aesthetic challenges if delay is too long.
Benefit/harms assessment	Balance of benefits and harms
Value judgments	None
Intentional vagueness	Delay is purposely not defined.
Role of patient preference	Strong- patient preference should play a large role in this decision.
Exclusions	None
Differences of opinion	None

and graft necroses were reported in a minority of cases after both immediate and delayed repairs, but differences in methodology and types of repairs included preclude direct comparisons.[10,13] Regarding patient satisfaction, in one study of immediate reconstruction, 98 percent reported absence of aesthetic discomfort and absence of, or mild, effect on quality of life. Overall patient satisfaction was 92 percent.[11]

Studies of asynchronous reconstruction, and comparative studies of immediate versus delayed reconstruction, appear to disproportionately include larger postcancer excision defects, such as those that require flap or graft repairs, or those at anatomically sensitive areas, such as the nose, hand, and foot. Smaller defects, as well as those at less aesthetically and functionally sensitive areas, are generally repaired immediately. Hence, comparative data for these are not available.

Reconstruction after skin cancer resection can be performed on the same day or after an interval of days to weeks. For certain types of repairs, such as skin or composite grafts on anatomically sensitive areas or those with cartilage resection, waiting to perform reconstruction may in some cases improve graft survival and contour. Logistical benefits of delayed reconstruction may include additional time to discuss reconstructive options with patients and time to prepare for general anesthesia when this is needed for the repair or preferred to manage patient anxiety. Physician and patient fatigue may be reduced by delaying the repair, with patients undergoing general anesthesia for the repair only having to restrict eating and drinking for a briefer period. For larger repairs, delay may allow the total local anesthetic dose to be minimized and kept in a safe window. When a surgeon with specialized expertise is required for reconstruction, delay may facilitate scheduling and handover. On the other hand, risks, harms, and costs of delaying reconstruction include patient inconvenience, as patients may need to manage a potentially unstable open wound at home. Patients may need to change or reinforce wound dressings. Bleeding complications at home may necessitate additional office or hospital visits. Although risk of infection is not increased with asynchronous reconstruction, patients may be anxious about this and about other perceived risks of delayed reconstruction. Excessively long time intervals prior to reconstruction may potentially lead to elevated risk of contractures and aesthetic impairment. Additional

direct and indirect costs of delayed reconstruction include the patient and their caregivers needing to take additional time off work, as well as the additional costs associated with the involvement of multiple surgeons.

Overall, there is an equilibrium between the benefits and harms of delayed versus immediate reconstruction. Aesthetic and functional outcomes, infection rates, other surgical complications, and patient satisfaction do not appear to systematically differ based on the timing of repairs. Delayed reconstruction is not more risky than immediate reconstruction. Immediate or delayed reconstruction may each be appropriate in particular circumstances. Patient characteristics and logistical feasibility may impact decision-making regarding the appropriateness of delay. Patient preference should also be taken into consideration. In certain unusual circumstances, such as in the case of planned postoperative radiation therapy, delay could interfere with the initiation of further treatment, and the surgeon may need to balance the issues surrounding the reconstruction with the start of radiation. When delay is selected, the duration of delay may also vary. Based on the literature, it is not clear what the optimal time frame between resection and reconstruction may be (if any), and we do not have great evidence in this area. The ideal timing could vary based on the particular clinical scenario. Analysis of outcomes in cases with different time intervals between resection and reconstruction may be an area for further investigation.

Recommendation 2: The work group suggests that clinicians should not routinely prescribe systemic antibiotic therapy in the interim between resection and reconstruction for adult patients undergoing reconstruction after skin cancer resection.

Evidence Quality: Low

Recommendation Strength: Weak

Recommendation 2: Rationale (Table 4)

There are occasions when immediate reconstruction following skin cancer resection may not be feasible, and there is a time interval between the point when the cancer is fully removed and the patient undergoes reconstruction. When such an interim period occurs, the surgeon may choose to provide antibiotic prophylaxis during the time between resection and reconstruction. No studies have compared the use and nonuse of antibiotic prophylaxis during a standardized period of postponement between resection and reconstruction. One randomized controlled trial that compared the utility of 2 g of cephalexin to placebo delivered 1 hour before flap or graft reconstructions of the nose or ear found that antibiotic prophylaxis reduced the risk of surgical-site infections but not of tissue necrosis nor wound dehiscence.[15] A randomized study of 203 *Staphylococcus aureus* nasal carriers found that decolonization with intranasal mupirocin and chlorhexidine body wash before skin cancer excision did not reduce the rate of surgical-site infections after reconstruction.[16] Neither study measured nor otherwise characterized the duration of delay, if any, between resection and reconstruction.

In the absence of data showing convincing benefits, systemic antibiotic therapy does not appear necessary or desirable in most cases when there is an interval between cancer resection and reconstruction. The benefits of avoiding antibiotics include reduced risk of antibiotic resistance, avoidance of drug-related side effects, cost savings, and minimization of possible drug interactions. Potential risks, harms, and costs include the possible low risk of infection if the patient is not compliant with instructions or engages in activities that increase the risk of infection; possible patient anxiety regarding the risk of infection; and the time and effort required to educate physicians that antibiotics are not needed in this context.

Notably, there are cases in which antibiotic use may be appropriate when reconstruction is coordinated to be completed at a separate setting. Diabetic patients, immunocompromised patients, the intravenous drug—addicted, and other patients at high risk of infection may benefit from systemic antibiotics while they are awaiting reconstruction. If a patient has been told that antibiotics are needed before any surgery, it may be prudent for the surgeon to consult with the patient's other physicians. This may help the surgeon better understand whether the relevant risk factors suggest a need for longer-term prophylaxis during the interim between cancer removal and repair. Finally, the general recommendation that antibiotics not be used when reconstruction is not immediate is not meant to exclude or discourage the use of perioperative antibiotics, which are routinely appropriate, particularly in the facility setting (see Recommendation 3).

Recommendation 3: 3a. The work group suggests that clinicians may administer perioperative (i.e., no more than 24 hours before surgery) systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in a *facility* (*non—office-based*) setting.

Evidence Quality: Low

Recommendation Strength: Weak

Recommendation 3: 3b. The work group recommends that clinicians should not

Table 4. Recommendation 2

Recommendation 2	The work group suggests that clinicians should not routinely prescribe systemic antibiotic therapy in the interim between resection and reconstruction for adult patients undergoing reconstruction after skin cancer resection.
Evidence quality	Low
Recommendation strength	Weak
Benefits	• Reduced antibiotic resistance. • Reduced side effects. • Reduced cost. • Reduced possible drug-drug interactions.
Risks, harms, and costs	• Possible low risk of infection if patient is not compliant with instructions or patient engages in activity that increases risk of infection. • Need to educate physicians that wound healing is not improved with antibiotics. • Possible patient anxiety about risk of infection.
Benefit/harms assessment	Preponderance of benefit over harm.
Value judgments	None
Intentional vagueness	Interim is any period between resection and reconstruction.
Role of patient preference	Moderate; patients need to be educated to understand antibiotic resistance.
Exclusions	None
Differences of opinion	None

routinely administer perioperative systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in the *office-based* setting.

Evidence Quality: Moderate

Recommendation Strength: Moderate

Recommendation 3: 3a and 3b Rationale (Tables 5 and 6)

Among the measures proposed to reduce the risk of infection associated with reconstruction following skin cancer removal is administration of systemic antibiotics. Perioperative systemic antibiotics may be administered orally or intravenously. The duration of treatment with perioperative antibiotics is typically brief.[15,17] Definitions of surgical-site infections vary. A formulation commonly used by researchers is that promulgated by the U.S. Centers for Disease Control and Prevention, which requires at least one of the following within 30 days of surgery: purulent discharge; localized swelling, pain, or heat; erythema more than 1 cm from the wound edge; or patient report of increasing tenderness.[18] Infection may also be assessed by clinical impression, culture positivity, or the incidence of adverse infection-associated outcomes, such as necrosis or dehiscence.[17]

There are conflicting outcomes in studies evaluating the effectiveness of perioperative antibiotics in preventing surgical-site infections as defined above. One randomized controlled trial of flap and graft reconstructions on the nose and ear in the office-based setting detected a significantly lower rate of surgical-site infection in the group pretreated with 2 g of oral cephalexin 1 hour before surgery versus the group that did not receive pretreatment (1.4 percent versus 11.6 percent).[15] However, this study included a somewhat unusual treatment paradigm. The skin cancer removal preceding reconstruction was completed with a staged excision with 2-day intervals and temporary dressing applications between stages, which may have contributed to the introduction of contaminants and the high rate of infection detected. In the same study, no difference was noted across groups in the rate of wound dehiscence or flap necrosis, with a single case (1.4 percent) of the former in the antibiotic prophylaxis group and a single case of the latter in the control group.[15] A multicenter cohort study of consecutive reconstructions after skin cancer resection found no difference in the rate of infection, as assessed by clinical impression and culture positivity, between the group treated with perioperative oral antibiotics and the untreated group.[17] There was also no difference in the incidence of total adverse events between the antibiotic and no antibiotic groups, and the group receiving antibiotics was not less likely to experience delayed healing, such as partial or full necrosis. In this study, the overall risk of surgical-site infection was less than 0.40 percent.[17] Other observational studies have similarly detected surgical-site infection rates of less than 1 percent associated with clean office-based reconstructions of skin cancer excision wounds in the absence of perioperative antibiotic prophylaxis.[19,20] A meta-analysis of randomized controlled trials of clean and clean-contaminated operations in plastic surgery found that antibiotic prophylaxis was associated with a 47 percent

Table 5. Recommendation 3a

Recommendation 3a	The work group suggests that clinicians may administer perioperative (i.e., no more than 24 hours before surgery) systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in a facility (non–office-based) setting.
Evidence quality	Low
Recommendation strength	Weak
Benefits	• Compliance with hospital and regulatory protocols. • Possible reduction of infection rates.
Risks, harms, and costs	• Side effects. • Cost. • Drug-drug interaction. • Allergic reaction. • Contributes to antibiotic resistance.
Benefit/harms assessment	Small preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
Exclusions	None
Differences of opinion	None

Table 6. Recommendation 3b

Recommendation 3b	The work group recommends that clinicians should not routinely administer perioperative systemic antibiotics for adult patients undergoing reconstruction after skin cancer resection in the office-based setting.
Evidence quality	Moderate
Recommendation strength	Moderate
Benefits	• No cost. • No side effects. • No drug-drug interactions. • Less time for delay to reconstruction. • Complications of intravenous or per os delivery avoided. • No contribution to antibiotic resistance.
Risks, harms, and costs	• Negative perception if an infection does occur.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
Exclusions	None
Differences of opinion	None

reduction in risk of surgical-site infection, but longer-term antibiotic use was not superior to shorter-term use.[21]

For infection risk after reconstruction following skin cancer resection, there is more evidence available for reconstructions in the office-based setting than in the facility setting. In general, reconstruction in the office-based setting appears to be associated with an exceedingly low risk of infection, which is not mitigated further by use of perioperative antibiotics. In the facility setting, risk of infection during complex reconstructions and clean-contaminated operations, as well as in special high-risk populations, may in some cases be greater. Hence, use of perioperative antibiotic prophylaxis may be appropriate in the facility setting. There is no evidence in either setting that long- term antibiotic prophylaxis provides infection risk reduction compared with short-term prophylaxis.

Consequently, in the *facility setting*, perioperative systemic antibiotics may be administered, albeit for no longer than 24 hours, for reconstruction following skin cancer removal. Potential benefits of this approach include compliance with hospital and regulatory protocols, as well as possible reduction of surgical-site infection rates. Potential risks, harms,

and costs appear to be collectively less significant, and include antibiotic-related side effects, the cost of medication, possible drug-drug interactions, risk of allergic reaction, and contributing to system-wide antibiotic resistance. Notably, ambulatory surgery centers should comply with state laws and regulations pertaining to antibiotic prophylaxis.

Based on the preponderance of evidence, in the *office setting*, it is recommended that clinicians *not* administer routine perioperative systemic antibiotics. Benefits of avoiding antibiotic prophylaxis include cost savings, absence of antibiotic side effects, prevention of drug-drug interactions, reduced time delay prior to reconstruction, avoidance of complications associated with oral or intravenous administration, and absence of contribution to antibiotic resistance. Potential risks and harms include medicolegal vulnerability if an infection occurs. Exclusions to this recommendation are appropriate for reconstructions in special high-risk populations, such as those requiring large or complex reconstructions, those with clean-contaminated or chronic wounds, and those with medical histories or comorbidities associated with immunosuppression or elevated risk of infection. Patient education on the need for antibiotic stewardship may help convey to patients that antibiotic prophylaxis is not without risk, and avoidance of such may be in their best interest.

Recommendation 4: 4a. The work group recommends that clinicians should continue anticoagulant, antithrombotic, and antiplatelet medications for adult patients undergoing reconstruction after skin cancer resection in the office-based setting.

Evidence Quality: Moderate

Recommendation Strength: Moderate

Recommendation 4: 4b. The work group recommends that clinicians should coordinate with the physician managing the anticoagulation medication before modifying the medication prior to reconstruction procedures in a *facility* (*non−office-based*) setting.

Evidence Quality: Not applicable (good practice recommendation)

Recommendation Strength: Not applicable

Recommendation 4: 4a and 4b Rationale (Tables 7 and 8)

Perioperative bleeding can occur in the context of oral anticoagulant, antithrombotic, and antiplatelet medications that may be concurrently dosed at therapeutic levels to manage patient comorbidities, such as risk of stroke, myocardial infarction, and pulmonary embolus. The combined evidence from six studies derived predominantly from hospital-based settings revealed no difference in the rate of occurrence of perioperative bleeding or hematoma in patients who had been administered a relevant pharmacologic agent prior to the onset of surgery, as versus those who had not.[22-27] Most selected studies compared aspirin, warfarin, or clopidogrel to placebo or no medication,[22-24,26] and one also assessed the effect of newer anticoagulant agents.[27] Studies were generally of low quality, with the reported duration of bleeding assessment after surgery ranging from immediately after completion of surgery to 4 weeks later.[24-27] All but one of the selected studies assessed the bleeding risk on both flap and graft repairs,[22-25,27] with one including flaps only.[26] One high-quality randomized controlled trial,[22] which assessed the impact of aspirin, provided the drug to the treatment group for 3 months before surgery, and detected no difference in the volume of bleeding within 24 hours postoperatively.

Pragmatic case series and cohort studies that have detected a higher rate of bleeding in reconstructions associated with anticoagulant use recommend continuing such medications perioperatively, as the same studies have noted that cases of increased bleeding did not result in serious consequences for patients.[28-31] On the other hand, there are numerous case reports of medication cessation being associated with death as well as serious adverse events, including strokes, cerebral emboli, myocardial infarctions, transient ischemic attacks, deep venous thromboses, pulmonary emboli, and retinal artery occlusion leading to blindness.[32-35]

Potential benefits of continuing anticoagulant, antithrombotic, and antiplatelet medications include, most importantly, reduced risk of any thromboembolic event and reduction in mortality. From a patient standpoint, not stopping medications may improve compliance, decrease patient confusion, and reduce the risk that medications will inadvertently be managed improperly. Potential risks of continuing medications perioperatively are milder, including slightly increased risk of bleeding, which may require bandage change, or further measures to secure the reconstruction with additional sutures or pressure dressings. Concurrent concerns may be a minor elevation in the risk of graft or flap loss, possible delay in wound healing, increased duration of the procedure, patient inconvenience relating to returning to the physician for a bleeding-associated complication, and the direct and indirect medical costs of additional medications, office visits, or procedures that may be required. Conceivably, surgeons concerned about a bleeding-associated complication may choose a less

Table 7. Recommendation 4a

Recommendation 4a	The work group recommends that clinicians should continue anticoagulant, antithrombotic, and antiplatelet medications for adult patients undergoing reconstruction after skin cancer resection in the office-based setting.
Evidence quality	Moderate
Recommendation strength	Moderate
Benefits	• Reduced risk of any thromboembolic event. • Increased patient compliance/decreased patient confusion regarding medication. • Reduced mortality.
Risks, harms, and costs	• Slightly increased risk of bleeding (from 1% to 2%, which might require a bandage change or additional stitch). • Minor risk of graft or flap (tissue) loss. • Possible delayed wound healing. • Inconvenience to patients if they need to return to physician for a complication. • Cost of medication. • Possible increased duration of procedure or multiple procedures. • Cost of multiple visits or procedures. • Possible compromised aesthetic outcome if surgeon elects to use a less aesthetically pleasing technique due to concerns about bleeding risk.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
Exclusions	Consultation is advisable/appropriate when there is felt to be significant risk/consequences of bleeding, in order to weigh risk of bleeding against the risk of thromboembolic events.
Differences of opinion	None

Table 8. Recommendation 4b

Recommendation 4b	The work group recommends that clinicians should coordinate with the physician managing the anticoagulation medication before modifying the medication prior to reconstruction procedures in a facility (non−office-based) setting.
Evidence quality	N/A (good practice recommendation)
Recommendation strength	N/A
Benefits	• Ensures appropriate process for bridging or stopping the patient's medication.
Risks, harms, and costs	• Physician time. • Possible delay in surgery to arrange call.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
None Exclusions	None
Differences of opinion	None

N/A, Not applicable.

aesthetically or functionally optimal repair to minimize the risk. Importantly, the risks, harms, and costs of continuing oral anticoagulant, antithrombotic, and antiplatelet medications can be collectively characterized as minor inconveniences and costs, while the potential benefits are reduction in the incidence of severe adverse events and death.

Additional Considerations in the Facility Setting

In the facility setting, there are numerous factors to consider in management of anticoagulant therapy perioperatively, predominantly weighing the risks associated with cessation against those of continuation: frequent but minor increased risk of bleeding

and associated complications versus rare but serious risk of stroke and thromboembolism. The risks involved in cessation of anticoagulants may differ significantly according to the indications for which they are prescribed. In some cases, continuation is essential (i.e., recent placement of drug-eluting cardiac stent), and cessation can have serious or fatal consequences.[36,37] For other indications, a brief inter ruption during the perioperative period may not have any negative effects. In the large cohort study by Douketis et al., in *The New England Journal of Medicine*, patients with atrial fibrillation treated with warfarin were separated into two groups: one had bridging with low-molecular weight heparin and the other stopped anticoagulation medication perioperatively. There was no increase in thromboembolism in the group undergoing surgery without anticoagulation.[38]

Overall, the risk of bleeding and resulting complications may differ significantly according to the extent and method of reconstruction. While in the office-based setting, the harms of continuation may be low, in certain facility-based cases, when the surgeon anticipates a higher risk of bleeding and/or significant negative consequences from bleeding sequelae, consideration may need to be given to bridging or stopping the anticoagulant.

Anticoagulation management perioperatively requires decision-making that should involve the surgeon, the physician managing the anticoagulation (e.g., primary care physician, cardiologist, and so on), and patient. When complex reconstructive procedures involving flaps or grafts are planned in the facility setting, bleeding risk potentiates complications and possible failure of the reconstruction. In some situations, anticoagulant management is more critical than in a straightforward excision and repair, where it may be continued. Reversible agents used in bridging treatment provide flexibility when bleeding events are encountered and may be a safer alternative. On the other hand, some patients with significant increased risk of thromboembolism (i.e., personal history of thromboembolism or bleeding disorders) may need to continue anticoagulant therapy despite the risk to surgical outcomes. Consultation with the primary physician, cardiologist, or other prescribing clinician is helpful in weighing risks and benefits and allows for a coordinated approach to therapeutic management.

Furthermore, the majority of the available evidence on these agents details the usage of aspirin and warfarin, and data are limited with respect to the consequences and effects of multiagent anticlotting treatments, as well as the newer generation of oral anticoagulants. The irreversibility of newer agents and associated risks are difficult to evaluate, as there is a lack of available data. It may be difficult to make blanket recommendations for all agents until more evidence is available, and this highlights a need for future investigation.

Recommendation 5: 5a. The work group recommends that clinicians should not routinely prescribe narcotic medication as first-line treatment for pain in adult patients undergoing reconstruction after skin cancer resection.

Evidence Quality: Moderate

Recommendation Strength: Moderate

Recommendation 5: 5b. The work group recommends that clinicians should prescribe acetaminophen and nonsteroidal anti- inflammatory drugs as first-line therapy in adult patients undergoing reconstruction for skin cancer resection.

Evidence Quality: Moderate

Recommendation Strength: Moderate

Recommendation 5: 5a and 5b Rationale (Tables 9 and 10)

There is increasing evidence that prescription narcotics, which surgical patients are four times as likely to receive upon discharge compared with nonsurgical patients, are associated with an increased risk of opioid diversion, addiction, unintentional injury, and death.[39] Patients who fill narcotic prescriptions after minor surgical procedures are more likely to exhibit persistent opioid use,[40] and the duration of the prescribed use is a predictor of future misuse.[41]

In the realm of reconstruction after skin cancer removal, a randomized clinical trial comparing oral postoperative pain management regimens did not shown narcotics to be more effective.[42] Specifically, patients undergoing reconstruction of head and neck wounds were assigned to receive one of the following every 4 hours after surgery: 1000 mg of acetaminophen, 1000 mg of acetaminophen plus 400 mg of ibuprofen, or 325 mg of acetaminophen plus 30 mg of codeine. Pain was assessed by patient self-report using a visual analog scale immediately after surgery and at 2, 4, 8, and 12 hours postoperatively. Subgroups were compared based on the area of the reconstructed defect. At 2 and at 4 hours, the acetaminophen plus codeine group reported more pain than the acetaminophen plus ibuprofen group. At other time points, no difference was seen in mean change in pain scores across the groups. At no time point was the regimen including the narcotic agent found to control pain better than either of the other two nonnarcotic regimens. Overall patient satisfaction, measured at the end of the study, did not differ

Table 9. Recommendation 5a

Recommendation 5a	The work group recommends that clinicians should not routinely prescribe narcotic medication as first-line treatment for pain in adult patients undergoing reconstruction after skin cancer resection.
Evidence quality	Moderate
Recommendation strength	Moderate
Benefits	• Avoids risk of addiction. • Avoids side effects (nausea, vomiting). • Reduces number of opioid pills in circulation. • Reduces cost of medication. • Possibly improves pain control. • Reduced risk of morbidity and mortality.
Risks, harms, and costs	• Perception of patient dissatisfaction. • Time to educate patient on why narcotics are not needed. • Possible increased patient anxiety. • Inconvenience to patient for delay in obtaining narcotic prescription. • Side effects of alternatives (kidney, liver, or gastrointestinal conditions). • Risk of illegal procurement of narcotics.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
Exclusions	None
Differences of opinion	None

Table 10. Recommendation 5b

Recommendation 5b	The work group recommends that clinicians should prescribe acetaminophen and nonsteroidal anti-inflammatory drugs as first-line therapy in adult patients undergoing reconstruction for skin cancer resection.
Evidence quality	Moderate
Recommendation strength	Moderate
Benefits	• Possibly improved pain control. • Reduced risk of morbidity and mortality. • Lower cost (especially if 600-mg ibuprofen is prescribed).
Risks, harms, and costs	• Side effects (kidney, liver, or gastrointestinal).
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	None
Role of patient preference	None
Exclusions	Patients with renal or liver conditions that preclude the use of either over-the-counter option or patients allergic to an alternative
Differences of opinion	None

between the codeine group and either of the other two groups.[42]

Additional studies on the use of narcotics in cutaneous surgery are consistent with these findings. A study of facial plastic surgeons performing rhinoplasties found that patients prescribed narcotics typically use less than half of the prescribed quantity,[43] and this was confirmed in an observational study of plastic surgery of the face.[44] Retrospective and prospective case series that compared narcotic and nonnarcotic postoperative pain strategies found no difference in surgical outcomes.[45,46] Long-lasting field blocks with agents such as liposomal bupivacaine have not been well-studied in reconstruction after skin cancer excision.[47]

The preponderance of evidence supports the recommendation that narcotic pain medications should not be the first-line treatment for the

management of pain following reconstruction after skin cancer resection. Benefits of not using narcotics include avoiding the risk of addiction, avoiding medication side effects such as nausea and vomiting, reducing the number of opioid pills in circulation as well as the risk of opioid diversion, reducing the risk of opioid-associated morbidity and mortality, and possibly improving pain control. Risks, harms, and costs of narcotic avoidance are collectively less concerning, and include the time required to educate patients as to why narcotics are not needed, increased patient anxiety associated with the possibility of breakthrough pain, inconvenience for those patients who must return to the physician's office or otherwise wait for a narcotic prescription when such is later found to be needed, side effects or lack of tolerability of alternative pain medications, and risk of illegal procurement of narcotics. When patient dissatisfaction occurs in the context of narcotics being withheld, this is likely based on patient misperceptions regarding the need for narcotics rather than actual postoperative discomfort or debility associated with a nonnarcotic pain control regimen. Patient, and in some cases physician, education is important to dispel incorrect beliefs about the need for initial narcotics. When in exceptional cases (e.g., extensive reconstructive procedures) narcotic pain management is required, prescriptions should be for brief courses, typically less than 5 days. Additional considerations include adherence to state laws for narcotic prescribing and climbing the ladder of different nonnarcotic therapies as necessary. Patient input is important, and shared decision-making pertaining to non-narcotic pain strategies can be developed in a manner consistent with the Centers for Disease Control and Prevention's *Guideline for Prescribing Opioids for Chronic Pain*.[48]

The evidence suggests that ibuprofen and acetaminophen are effective in reducing post-operative pain after skin cancer reconstruction. The work group recommends that a combination of acetaminophen and nonsteroidal antiinflammatory drugs (NSAIDs) (such as ibuprofen) be used as first-line therapy for pain control. The benefits of this approach include those noted above, as well as the lower cost of medication. There are, in general, minimal apparent risks, harms, or costs. Excluded are patients with gastrointestinal, renal, or liver conditions that preclude the use of either NSAIDs or acetaminophen, as well as patients with drug allergies or contraindications to these agents. To be most effective, NSAIDs and acetaminophen should be started immediately after surgery and dosed on a regular schedule.[42] Patients should not wait for breakthrough pain to take these drugs. Physicians reluctant to prescribe postoperative NSAIDs because of bleeding concerns may also be apprised of the evidence that this does not increase bleeding risk. Future research may assess the utility of liposomal bupivacaine and other field block anesthetic agents after larger reconstructions.

Recommendation 6: The work group suggests that clinicians discuss management of pain, antibiotics, and anticlotting agents with adult patients undergoing reconstruction after skin cancer resection when relevant.

Evidence Quality: Not applicable

Recommendation Strength: Not applicable (good practice recommendation)

Recommendation 6: Rationale (Table 11)

There are currently no standardized protocols for how the doctor and patient will manage pain medications, possible oral antibiotics, or anticoagulation (anticlotting) medications during the perioperative period in patients undergoing reconstruction after skin cancer resection. Although contextual differences in these procedures and settings should be considered, clear and consistent communication with the patient is imperative. The physician or their designee should share a typical pain management strategy, discussion of antibiotic use (or avoidance), and plan for those patients taking anticlotting agents. The benefits of this patient education are numerous and are highlighted below.

The importance of patient education and the shared decision-making between the physician and patient are highlighted in this statement. Educating patients about their perioperative treatment through discussion of treatment strategies may help alleviate anxiety, improve communication, increase patient satisfaction, and maximize patient compliance with the post-operative orders. This process may also strengthen the doctor- patient relationship, which may decrease patient complaints, increase patient safety, and decrease potential litigation. The work group considered perioperative discussion of pain management, use of postoperative antibiotics, and perioperative use of anticlotting agents to be of paramount importance in the patient education process.

Patients commonly prepare for their reconstruction after skin cancer resection using available internet and social media sources, which may create confusion due to conflicting information. To avoid misunderstanding, the work group considers the preoperative discussion an optimal time to improve patient education and set expectations for the post-operative pain management protocol that will be used. Developing a strategy in the preoperative period also alleviates anxiety, as the patient

Table 11. Recommendation 6

Recommendation 6	The work group suggests that clinicians discuss management of pain, antibiotics, and anticlotting agents with adult patients undergoing reconstruction after skin cancer resection when relevant.
Evidence quality	N/A
Recommendation strength	N/A (good practice recommendation)
Benefits	• Increased patient satisfaction. • Increased patient compliance with recommended regimens. • Improved patient/physician relationship. • Minimization of litigation. • Minimization of complaints. • Improved patient safety.
Risks, harms, and costs	• Physician burden in reporting and time.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	It is left to clinician's judgment what constitutes "relevant."
Role of patient preference	None
Exclusions	None
Differences of opinion	None

N/A, Not applicable.

understands and has prepared for managing the postoperative pain with an appropriate guideline. Documentation of this discussion in the medical record is a critical part of the education process. Patients should be encouraged to seek clarification to maximize their educational experience.

Specific Suggestions

The physician or physician designee should summarize a pain management strategy and emphasize that pain will not be prevented entirely. Other topics to review may include the following: anticipated bruising, swelling, discharge of fluids from the surgical sites, and possible activities that would exacerbate pain. The work group strongly advocates for a tiered approach to managing pain. In tier 1, ice and elevation may reduce swelling and discomfort, while wounds may be bandaged and kept moist. Nonnarcotic pain medications are emphasized. These may include acetaminophen, ibuprofen, naproxen, gabapentin, and others. Breakthrough pain may, in certain circumstances, be treated with narcotic pain medications as tier 2.

The work group has outlined the use of perioperative systemic antibiotics in recommendation 3 and postoperative antibiotics in recommendation 2, and these will not be reiterated herein. Available evidence does not show a significant benefit to the use of postoperative antibiotics in this patient population.[15,16] For this reason, the work group suggests that the physician or physician designee communicate to the patient that no routine oral antibiotics will be ordered. Patients may be comforted to know that oral antibiotics will not be discouraged if they happen to show evidence of a wound infection.

A challenge encountered in some patients undergoing reconstruction after skin cancer resection is the patient's use of antiplatelet medications or anticoagulants due to cardiac arrhythmias or hypercoagulable states (e.g., deep venous thrombosis, pulmonary embolism, or cerebrovascular accidents). Recommendation 4 addresses such patients. The work group suggests that patients be counseled on how the risks of continuing the anticlotting medications (e.g., increased bleeding, possible flap hematoma) need to be balanced with the potential devastating consequences of a systemic thrombotic event. The work group recognizes that patients should utilize their primary care physician, cardiologist, or other specialists to help better understand their risks for undergoing procedures while using their anticlotting agents.

The work group recognizes that effects of the patient education measures suggested above are difficult to measure. Measuring patient understanding is wrought with contextual confounding variables. Patient-reported outcome measures and patient satisfaction surveys may not accurately measure the success of these interventions. We encourage physicians or their designees to deliver a consistent patient education, while directing patients to complementary material in pamphlets or internet- based resources. By creating an opportunity for patients to inquire about pain management, antibiotic use, and management of anticlotting agents, the work group anticipates improved patient satisfaction, improved patient compliance, and

Table 12. Recommendation 7

Recommendation 7	The work group suggests that clinicians may offer postoperative follow-up assessment to adult patients undergoing reconstruction after skin cancer resection.
Evidence quality	N/A
Recommendation strength	N/A (good practice recommendation)
Benefits	• Increased patient/physician communication. • Patient empowered to express satisfaction. • Allows for collection of patient-reported outcome measures. • Identifies patients who may benefit from further management or counseling. • Quality improvement.
Risks, harms, and costs	• Cost of visit, travel, time. • Time of outcome assessment/collection.
Benefit/harms assessment	Preponderance of benefit over harm
Value judgments	None
Intentional vagueness	Follow-up interval or outcome measure not defined
Role of patient preference	Small
Exclusions	None
Differences of opinion	None

N/A, Not applicable.

potentially improved surgical outcomes. A sample of a patient handout can be found in **Appendix B, Supplemental Digital Content 2**, available on www.jaad.org. This is only an example and is not meant to be a required element.

Recommendation 7: The work group suggests that clinicians may offer postoperative follow-up assessment to adult patients undergoing reconstruction after skin cancer resection.

Evidence Quality: Not applicable

Recommendation Strength: Not applicable (good practice recommendation)

Recommendation 7: Rationale (Table 12)

Reconstruction after skin cancer resection may have myriad functional and cosmetic outcomes. The return of the patient for follow-up visits is an excellent opportunity to better understand and measure these outcomes, improve patient-physician communication, and foster quality improvement. Postoperative follow-up can lead to increased communication between the patient and physician, thereby empowering patients to comment on satisfaction and other important outcomes measures. This communication is an opportunity to increase patient and family engagement and offer the patient appropriate patient-reported outcome measures. Follow-up visits can provide an opportunity to identify areas for technique enhancement, improve patient satisfaction, and identify patients who may benefit from further counseling or management. Quality improvement projects and scientific outcome studies can be designed through appropriate follow-up. To contrast the aforementioned benefits of postoperative follow-up, there may be associated costs. These could be in the form of patient travel expense, time, or cost associated with office visit billing. In addition, collection and assessment of outcome measures may cost the physician time and administrative resources. In some cases, it may be impractical for patients to return for follow-up to the reconstructive surgeon (i.e., rural areas where patients have traveled great distances for treatment), and in these cases, postoperative care and coordination may be arranged with a local physician.

There is a paucity of evidence regarding optimal timing for follow-up. Based on the anatomic site of reconstruction, there may be several different functional and cosmetic outcomes to be measured, and occasional spitting stitches can be identified at follow-up and removed. The work group did not reach consensus on minimal acceptable time for stable outcome assessment. Patient preference does have a role in establishing a timeline for communication and follow-up.

Overall, the work group found there was preponderance of potential benefit over harm in offering patients postoperative assessment following reconstruction after skin cancer resection. The interval and method of assessment are at the discretion of the physician. However, we encourage the use of validated patient-reported outcome measures and patient satisfaction tools specific to the site of reconstruction at an appropriate interval to achieve stable functional and cosmetic assessment.

CONCLUSIONS AND FUTURE DIRECTIONS

In general, research in the area of reconstruction after skin cancer resection was limited. Higher-quality studies in all topic areas addressed here would help strengthen guidance to practicing clinicians.

A variety of new research areas may add to potential improvements of the patient care delivery process with respect to reconstruction after skin cancer resection. Research areas that may contribute to better measurements of reconstructive outcomes after skin cancer resection may include development of patient-reported outcome measures. Collection of the patient's perception of the objective success of the reconstruction as well as the patient's satisfaction with the care delivery process can be captured with an instrument that is under development and in the process of content validity testing.[49]

Further studies looking at the newer types of anticoagulant medications in reconstruction after skin cancer resection are critical in both office-based and facility settings.

Investigations of outcomes with different timing intervals between resection and reconstruction may also be helpful in determining the optimal time window (if any) for asynchronous reconstruction.

Although the data did not support the use of antibiotics in the interval between resection and reconstruction, the work group did not specifically look at the question of whether antibiotic use would be beneficial in the postoperative period for patients undergoing delayed reconstruction. This could be another question to investigate.

The authors thank Heather Benfield, EdD, Catherine Bennett, Harvey P. Davidson, and Patricia Fee for serving on the work group as patient representatives. The authors thank the various organizations and individuals who participated in the peer review and public comment periods. Every comment was reviewed and considered by the work group.

REFERENCES

1. American Cancer Society. Cancer facts & figures 2017, 2017. Accessed February 1, 2019. Available at: https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2017/cancer-facts-and-figures-2017.pdf
2. Mohan SV, Chang AL. Advanced basal cell carcinoma: Epidemiology and therapeutic innovations. *Curr Dermatol Rep*. 2014;3:40-45.
3. Alam M, Armstrong A, Baum C, et al. Guidelines of care for the management of cutaneous squamous cell carcinoma. *J Am Acad Dermatol*. 2018;78:560-578.
4. Bichakjian C, Armstrong A, Baum C, et al. Guidelines of care for the management of basal cell carcinoma. *J Am Acad Dermatol*. 2018;78:540-559.
5. Shiffman RN, Michel G, Rosenfeld RM, Davidson C. Building better guidelines with BRIDGE-Wiz: Development and evaluation of a software assistant to promote clarity, transparency, and implementability. *J Am Med Inform Assoc*. 2012;19:94-101.
6. Goto H, Yoshikawa S, Mori K, et al. Retrospective evaluation of factors influencing successful skin grafting for patients with skin cancer of the foot. *J Dermatol*. 2017;44:1043-1045.
7. Robinson JK, Dillig G. The advantages of delayed nasal full-thickness skin grafting after Mohs micrographic surgery. *Dermatol Surg*. 2002;28:845-851.
8. Thibault MJ, Bennett RG. Success of delayed full-thickness skin grafts after Mohs micrographic surgery. *J Am Acad Dermatol*. 1995;32:1004-1009.
9. Koolen PGL, Matos TR, Ibrahim AMS, et al. Recurrence rates over 20 years in the treatment of malignant melanoma: Immediate versus delayed reconstruction. *Plast Reconstr Surg Glob Open*. 2017;5:e1378.
10. Oliver-Allen H, Piper M, Vaughn C, Sbitany H. Immediate reconstruction for plantar melanoma: A paradigm shift. *Ann Plast Surg*. 2017;78(5 Suppl 4):S194-S198.
11. Topin-Ruiz S, Surinach C, Dalle S, Duru G, Balme B, Thomas L. Surgical treatment of subungual squamous cell carcinoma by wide excision of the nail unit and skin graft reconstruction: An evaluation of treatment efficiency and outcomes. *JAMA Dermatol*. 2017;153:442-448.
12. Escobar V, Zide MF. Delayed repair of skin cancer defects. *J Oral Maxillofac Surg*. 1999;57:271-279. discussion 279.
13. Mordick TG, Hamilton R, Dzubow LM. Delayed reconstruction following Mohs' chemosurgery for skin cancers of the head and neck. *Am J Surg*. 1990;160:447-449.
14. Patel SA, Liu JJ, Murakami CS, Berg D, Akkina SR, Bhrany AD. Complication rates in delayed reconstruction of the head and neck after Mohs micrographic surgery. *JAMA Facial Plast Surg*. 2016;18:340-346.
15. Rosengren H, Heal CF, Buttner PG. Effect of a single prophylactic preoperative oral antibiotic dose on surgical site infection following complex dermatological procedures on the nose and ear: A prospective, randomised, controlled, double-blinded trial. *BMJ Open*. 2018;8:e020213.
16. Tai YJ, Borchard KL, Gunson TH, Smith HR, Vinciullo C. Nasal carriage of *Staphylococcus aureus* in patients undergoing Mohs micrographic surgery is an important risk factor for postoperative surgical site infection: A prospective randomised study. *Australas J Dermatol*. 2013;54:109-114.
17. Alam M, Ibrahim O, Nodzenski M, et al. Adverse events associated with Mohs micrographic surgery: Multicenter prospective cohort study of 20,821 cases at 23 centers. *JAMA Dermatol*. 2013;149:1378-1385.
18. Stevens DL, Bisno AL, Chambers HF, et al, Infectious Diseases Society of America. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014;59:e10-e52.
19. Cook JL, Perone JB. A prospective evaluation of the incidence of complications associated with Mohs micrographic surgery. *Arch Dermatol*. 2003;139:143-152.
20. Rogers HD, Desciak EB, Marcus RP, Wang S, MacKay-Wiggan J, Eliezri YD. Prospective study of wound infections in Mohs micrographic surgery using clean surgical technique in the absence of prophylactic antibiotics. *J Am Acad Dermatol*. 2010;63:842-851.
21. Zhang Y, Dong J, Qiao Y, He J, Wang T, Ma S. Efficacy and safety profile of antibiotic prophylaxis usage in clean and clean-contaminated plastic and reconstructive surgery: A

meta-analysis of randomized controlled trials. *Ann Plast Surg*. 2014;72:121-130.
22. Engheta A, Hadadi Abianeh S, Atri A, Sanatkarfar M. Aspirin use and bleeding volume in skin cancer patients undergoing surgery: A randomized controlled trial. *Daru*. 2016;24:20.
23. Eichhorn W, Haase M, Kluwe L, et al. Increased postoperative bleeding risk among patients with local flap surgery under continued clopidogrel therapy. *Biomed Res Int*. 2015;2015:120903.
24. Harbottle M, Telfer M, Hunjan PS, Knepil GJ, Singh RP. Bleeding complications in cutaneous surgery for patients on warfarin who have skin cancer of the head and neck. *Br J Oral Maxillofac Surg*. 2014;52:523-526.
25. Shipkov H, Irthum C, Seguin P, Mojallal A, Braye F. Evaluation of the risk of post-operative bleeding complications in skin cancer surgery without interruption of anticoagulant/antithrombotic medication: A prospective cohort study. *J Plast Surg Hand Surg*. 2015;49:242-246.
26. Dhiwakar M, Khan NA, McClymont LG. Surgical resection of cutaneous head and neck lesions: Does aspirin use increase hemorrhagic risk? *Arch Otolaryngol Head Neck Surg*. 2006;132:1237-1241.
27. Eilers RE Jr, Goldenberg A, Cowan NL, Basu P, Jiang SIB. A retrospective assessment of postoperative bleeding complications in anticoagulated patients following Mohs micrographic surgery. *Dermatol Surg*. 2018;44:504-511.
28. Bordeaux JS, Martires KJ, Goldberg D, Pattee SF, Fu P, Maloney ME. Prospective evaluation of dermatologic surgery complications including patients on multiple anti-platelet and anticoagulant medications. *J Am Acad Dermatol*. 2011;65:576-583.
29. Cook-Norris RH, Michaels JD, Weaver AL, et al. Complications of cutaneous surgery in patients taking clopidogrel-containing anticoagulation. *J Am Acad Dermatol*. 2011;65:584-591.
30. Otley CC, Fewkes JL, Frank W, Olbricht SM. Complications of cutaneous surgery in patients who are taking warfarin, aspirin, or nonsteroidal anti-inflammatory drugs. *Arch Dermatol*. 1996;132:161-166.
31. Billingsley EM, Maloney ME. Intraoperative and postoperative bleeding problems in patients taking warfarin, aspirin, and nonsteroidal antiinflammatory agents: A prospective study. *Dermatol Surg*. 1997;23:381-383. discussion 384.
32. Khalifeh MR, Redett RJ. The management of patients on anticoagulants prior to cutaneous surgery: Case report of a thromboembolic complication, review of the literature, and evidence-based recommendations. *Plast Reconstr Surg*. 2006;118:110e-117e.
33. Alam M, Goldberg LH. Serious adverse vascular events associated with perioperative interruption of antiplatelet and anticoagulant therapy. *Dermatol Surg*. 2002;28:992-998. discussion 998.
34. Schanbacher CF, Bennett RG. Postoperative stroke after stopping warfarin for cutaneous surgery. *Dermatol Surg*. 2000;26:785-789.
35. Kovich O, Otley CC. Thrombotic complications related to discontinuation of warfarin and aspirin therapy perioperatively for cutaneous operation. *J Am Acad Dermatol*. 2003;48:233-237.
36. Park DW, Park SW, Park KH, et al. Frequency of and risk factors for stent thrombosis after drug-eluting stent implantation during long-term follow-up. *Am J Cardiol*. 2006;98:352-356.
37. Levine GN, Bates ER, Bittl JA, et al. 2016 ACC/AHA guideline focused update on duration of dual antiplatelet therapy in patients with coronary artery disease: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Thorac Cardiovasc Surg*. 2016;152:1243-1275.
38. Douketis JD, Spyropoulos AC, Kaatz S, et al, BRIDGE Investigators. Perioperative bridging anticoagulation in patients with atrial fibrillation. *N Engl J Med*. 2015;373:823-833.
39. Brat GA, Agniel D, Beam A, et al. Postsurgical prescriptions for opioid naive patients and association with overdose and misuse: Retrospective cohort study. *BMJ*. 2018;360:j5790.
40. Harbaugh CM, Nalliah RP, Hu HM, Englesbe MJ, Waljee JF, Brummett CM. Persistent opioid use after wisdom tooth extraction. *JAMA*. 2018;320:504-506.
41. Harris K, Calder S, Larsen B, et al. Opioid prescribing patterns after Mohs micrographic surgery and standard excision: A survey of American Society for Dermatologic Surgery members and a chart review at a single institution. *Dermatol Surg*. 2014;40:906-911.
42. Sniezek PJ, Brodland DG, Zitelli JA. A randomized controlled trial comparing acetaminophen, acetaminophen and ibuprofen, and acetaminophen and codeine for postoperative pain relief after Mohs surgery and cutaneous reconstruction. *Dermatol Surg*. 2011;37:1007-1013.
43. Patel S, Sturm A, Bobian M, Svider PF, Zuliani G, Kridel R. Opioid use by patients after rhinoplasty. *JAMA Facial Plast Surg*. 2018;20:24-30.
44. Tinsbloom B, Muckler VC, Stoeckel WT, Whitehurst RL, Morgan B. Evaluating the implementation of a preemptive, multimodal analgesia protocol in a plastic surgery office. *Plast Surg Nurs*. 2017;37:137-143.
45. Parsa FD, Cheng J, Stephan B, et al. Bilateral breast reduction without opioid analgesics: A comparative study. *Aesthet Surg J*. 2017;37:892-899.
46. Kelley BP, Bennett KG, Chung KC, Kozlow JH. Ibuprofen may not increase bleeding risk in plastic surgery: A systematic review and meta-analysis. *Plast Reconstr Surg*. 2016;137:1309-1316.
47. Morales R Jr, Mentz H 3rd, Newall G, Patronella C, Masters O 3rd. Use of abdominal field block injections with liposomal bupivicaine to control postoperative pain after abdominoplasty. *Aesthet Surg J*. 2013;33:1148-1153.
48. Centers for Disease Control and Prevention. Guideline for prescribing opioids for chronic pain, 2017. Accessed February 1, 2019. Available at: https://www.cdc.gov/drugoverdose/pdf/Guidelines_ Factsheet-a.pdf
49. Christophel JJ. Mohs reconstruction patient reported outcome measure. Presented at: Combined Otolaryngology Spring Meetings, April 18—22, 2018, National Harbor, Md.

DISCLOSURE APPENDIX

All contributors and preparers of the guideline, including ASPS staff, disclosed all relevant conflicts of interest via an online disclosure reporting database. In accordance with the Institute of Medicine's recommendations for guideline development, members with a conflict of interest represented less than half of the guideline work group. **Andrew Chen, MD,** Work Group Co-Chair, has no relevant disclosures. **Murad Alam, MD, MSCI, MBA,** Work Group Co-Chair, serves as a consultant for Pulse Biosciences; served on the boards of directors of the American College of Mohs Surgery, the Illinois Dermatologic Society, and the Women's Dermatologic Society; and was on the editorial boards of the American Society for Dermatologic Surgery's *Dermatologic Surgery* and of the journal *Lasers in Medical Science*. **John G. Albertini, MD, Heather Benfield,** and **Catherine Bennett** have no relevant disclosures. **Jeremy S. Bordeaux, MD, MPH,** has served on the board of directors, *Dermatologic Surgery* journal, Director and Reconstruction Interest Group, Task Force on Value Analysis, Alternate CPT, Patient Education Workgroup, Audit Committee, and Surgical Directors Interest Group for the American Society for Dermatologic Surgery; the editorial board, Academic Dermatology Leadership Program, Clinical Guidelines Committee, and the Council on Science and Research for the American Academy of Dermatology; and the CME and Education Committee and National Registry and Outcomes Committee for the American College of Mohs Surgery. **Michael W. Chen, MD,** has no relevant disclosures. **Jonathan L. Cook, MD,** has served on the editorial board of *Dermatologic Surgery* and received royalties from Elsevier. **Caryn Davidson, MA, Harvey P. Davidson, Patricia J. Fee, Irfan I. Galaria, MD, MBA,** and **Catherine M. Hannan, MD,** have no relevant disclosures. **Jonathan Kantor, MD, MSCE,** has served as associate editor of the *Journal of the American Academy of Dermatology*, associate editor of *Dialogues in Dermatology*, and editor-in-chief of *JAAD International*; is a past president of the American Society for Mohs Surgery; and has received royalties from McGraw Hill. **Daniel L. Kapp, MD,** has served on the advisory board for and owns stock in MDLIVE, and serves as a consultant for Organogenesis. **Naomi Lawrence, MD,** has no relevant disclosures. **Clifford W. Lober, MD, JD,** has served on the board of directors for the American Academy of Dermatology and the board of governors for the Florida Medical Association. **Lauren D. Loeding, MPH,** and **Alexander Miller, MD,** have no relevant disclosures. **Daniel T. Ness, MD,** has investment shares in the Vanguard Health Fund and owns stock in Sientra. **Rogerio I. Neves, MD, Peter C. Revenaugh, MD, Pete Setabutr, MD, Katelyn C. Donnelly, MPH,** and **Sunil S. Tholpady, MD,** have no relevant disclosures. **Travis T. Tollefson, MD, MPH,** has served as editor-in-chief of *Facial Plastic Surgery & Aesthetic Medicine* and on the boards of directors for the *American Academy of Facial Plastic and Reconstructive Surgery* and the American Board of Otolaryngology-Head and Neck Surgery. **Marta J. Van Beek, MD, MPH,** serves as an officer of the American Academy of Dermatology and chief of staff of the University of Iowa Hospitals & Clinics, and receives a stipend for both positions. **Paul R. Weiss, MD,** owns healthcare-related retirement equities.