

## Preoperative Smoking Cessation: The Role of the Primary Care Provider

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Millions of cigarette smokers require surgery each year. Those who quit smoking may reduce their risk of respiratory, cardiovascular, and wound-related complications. Scheduling of surgery may present a unique opportunity to help smokers quit permanently. Primary care providers can play an important role in helping their patients scheduled for surgery quit smoking before their operation and maintain their abstinence after surgery. To do so effectively, physicians need to understand (1) the consequences of smoking in the perioperative period and how quitting can mitigate these problems, (2) how surgery can serve as a “teachable moment” to aid in smoking cessation, and (3) specific techniques that can be used to help their patients quit smoking, including brief counseling and pharmacotherapy.

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Primary care providers play an important role in the delivery of surgical services, often making the initial referral to a surgeon. Also, they may be asked to evaluate patients before elective surgical procedures to ensure that patients are optimally prepared to undergo the rigors of surgery and anesthesia. Such evaluation usually concentrates on the cardiovascular and respiratory systems because most serious perioperative complications involve these organ systems. However, one factor that may profoundly affect postoperative outcome often is not addressed—tobacco dependence. Tobacco use contributes considerably to the risk of respiratory, cardiac, and wound-related complications that can occur during or after surgery. Recent evidence suggests that these risks may be diminished by abstinence from tobacco in the perioperative period (defined here as the time from surgery scheduling until 30 days after surgery). Thus, effectively addressing tobacco use in the perioperative period may improve surgical outcomes.

A surgical episode represents a unique opportunity to help smokers quit permanently, with the potential for long-term benefit to the patient and to the public health. To-

bacco use is the major avoidable cause of death in the United States, responsible for nearly half a million deaths each year, and health care workers can play an important role in dealing with this problem. The multiple contacts of patients with the health care system inherent in the surgical process provide opportunities to intervene. Also, evidence suggests that surgery represents a “teachable moment” that could increase the efficacy of tobacco interventions. Finally, current policies in health care facilities include a period of mandatory abstinence from cigarettes before surgery, which may facilitate interventions. The primary care provider can play an important role in such efforts.

This review examines why it is important for surgical patients to abstain from tobacco in the perioperative period and how primary care clinicians can help them do so. Cigarette smoking is the most common and best-studied form of dependence; however, other forms of tobacco use may have deleterious consequences and could be addressed in the perioperative period.

### SMOKING AND PERIOPERATIVE COMPLICATIONS

Although smoking contributes to many perioperative complications, 3 are of greatest clinical importance: pulmonary complications, cardiovascular complications, and complications related to impaired healing of bones and surgical wounds.

Cigarette smokers are at increased risk of postoperative complications such as pneumonia and respiratory failure.<sup>1</sup> Although some of this risk may be explained by smoking-related respiratory pathology such as chronic obstructive pulmonary disease, complications may occur even in smokers who do not yet have overt lung disease. Contributing factors include retained secretions, caused by impaired ciliary function and enhanced mucus production, and alterations in lung immune responses. For example, alveolar macrophage function is impaired notably in smokers, weakening normal defense mechanisms against postoperative infection.<sup>2</sup> Anesthetic gases may impair macrophage function, even in healthy lungs; this inhibition is enhanced in smokers.<sup>3</sup>

Smokers have increased risk of perioperative cardiac complications such as myocardial ischemia and infarction.<sup>4</sup> Similar to pulmonary complications, this risk arises in part

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A question-and-answer section appears at the end of this article.

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because of the higher prevalence of cardiovascular disease related to tobacco dependence. For example, smoking promotes atherosclerosis by affecting lipids and producing endothelial damage, oxidant injury, neutrophil activation, and enhanced thrombosis.<sup>5</sup> However, short-term exposure to cigarette smoke also can contribute to vascular events by increasing coagulability, increasing sympathetic tone (which increases myocardial work and constricts coronary vessels), and decreasing the capacity of blood to carry oxygen (via exposure to carbon monoxide).

Smokers are more likely to have complications related to impaired healing, including wound dehiscence and infection<sup>6,7</sup> and nonunion of fractured bones.<sup>8</sup> The risk is increased especially in procedures that require substantial surgical undermining, such as many cosmetic surgical procedures. Potential contributing mechanisms include decreased tissue oxygenation secondary to vasoconstriction and carboxyhemoglobin and inhibition of immune responses important to wound healing. The relative contribution of the various components of cigarette smoke, including nicotine and carbon monoxide, is unknown.<sup>9</sup> Also, it is unclear whether complications related to impaired healing are a consequence of pathologic changes caused by long-term exposure to cigarette smoke (ie, microvascular disease caused by smoking-induced atherosclerosis) or short-term exposure to components of smoke such as nicotine.

### EFFECT OF SMOKING ABSTINENCE ON POSTOPERATIVE COMPLICATIONS

Quitting smoking reduces the risk of smoking-related disease in general, and perioperative complications are no exception. What is unknown in most cases is the minimum duration of preoperative abstinence necessary to confer benefit.

Smoking cessation is associated with a reduction in the risk of postoperative pulmonary complications; the frequency of complications in patients who have been abstinent for several months approaches that of patients who have never smoked.<sup>1,10,11</sup> Observational studies suggest that at least 2 months of preoperative abstinence is required for full benefit,<sup>10,12</sup> a finding consistent with physiological studies showing that some period is necessary before parameters such as mucociliary clearance and macrophage function recover from exposure to smoke.<sup>13</sup> How postoperative pulmonary complications are affected by smoking cessation immediately before surgery or by tobacco abstinence after surgery is unknown. Some researchers have interpreted such observational studies as showing that quitting smoking within a few weeks before surgery actually increases the risk of complications.<sup>11,14</sup> However, this conclusion is not supported by the data, and patients

should *not* be discouraged from quitting before surgery on this basis.

The effect of tobacco abstinence on cardiovascular complications is unclear, although presumably improvements in cardiovascular function that accompany smoking cessation should translate into improved patient outcomes. The duration of preoperative abstinence necessary to maximally reduce risk is unknown. Given the relatively short half-lives of smoke components such as carbon monoxide and nicotine (approximately 4 hours and 1 hour, respectively), even brief preoperative abstinence may be beneficial. For example, lower exhaled carbon monoxide concentrations are correlated with a decreased frequency of electrocardiographic abnormalities during general anesthesia.<sup>15</sup>

In general, the rate of wound-related complications in former smokers is similar to those who have never smoked, suggesting that prolonged tobacco abstinence reduces risk.<sup>6</sup> Recent studies show a substantial benefit in the rate of wound-related complications in orthopedic surgery patients who quit smoking several weeks before surgery.<sup>16</sup> The minimum duration of abstinence necessary for benefit is unknown, although studies of experimental wounds in human volunteers suggest that it is less than 4 weeks.<sup>17</sup>

Most of the beneficial effects of smoking cessation on postoperative complications were documented in patients who were able to maintain their postoperative abstinence from smoking. Unfortunately, many patients are unable to achieve this goal, and the effect of resuming smoking after surgery on postoperative outcomes is unknown.

### ELECTIVE SURGERY AS A “TEACHABLE MOMENT” FOR SMOKING CESSATION

The scheduling of elective surgery presents an excellent opportunity to provide interventions directed toward tobacco use. A “teachable moment” is an event that motivates individuals to change health behaviors that increase risk.<sup>18</sup> There is strong evidence that the concept applies to tobacco dependence because events such as disease diagnosis, pregnancy, and hospitalization may be associated with an increased spontaneous rate of smoking cessation compared with the general population. For example, 1-year self-reported tobacco abstinence rates after general hospitalization tend to be higher than the rate of spontaneous quitting in the general population (approximately 10%-15% vs 3%-5%, respectively).<sup>19</sup> For patients experiencing severe medical events clearly related to smoking, such as acute myocardial infarction, 1-year tobacco abstinence rates after hospital discharge may approach 50%.<sup>19</sup>

Patients hospitalized specifically for surgery have higher tobacco abstinence rates after hospital discharge

TABLE 1. The "5 A's" for Brief Intervention

Step	General recommendation	Adaptation to surgical patient
Ask about tobacco use	Identify and document tobacco use status for every patient at every visit	None
Advise to quit	In a clear, strong, personalized manner urge every tobacco user to quit	Recommend abstinence from at least 12 hours before surgery to at least 1 week after surgery
Assess willingness to make a quit attempt	Determine whether the tobacco user is willing to make a quit attempt at this time	Determine whether the tobacco user is willing to extend his or her required perioperative abstinence
Assist in quit attempt	For the patient willing to make a quit attempt, use counseling and pharmacotherapy to help him or her quit	Tailor assistance to the circumstances surrounding surgery
Arrange follow-up	Schedule follow-up contact, preferably within the first week after the quit date	Use routine postoperative surgical follow-up (in coordination with surgeon) to continue interventions

than the general population. The highest rates of prolonged postoperative abstinence, which may exceed 50%, are associated with major surgical procedures for tobacco-related diseases, such as lung resection for carcinoma and coronary artery bypass grafting.<sup>20</sup> Spontaneous tobacco abstinence rates are considerably lower after general noncardiothoracic surgery (approximately 8%-10% at 1 year after surgery).<sup>21</sup> Further evidence for the relationship between surgical intensity and its power as a teachable moment comes from a recent study that specifically examined postoperative tobacco abstinence rates in elective surgical procedures.<sup>22</sup> Patients who underwent more extensive surgical procedures that required hospital admission were more likely to remain abstinent from cigarettes for 30 days after surgery than were those who underwent more minor outpatient procedures.

Because nicotine is highly addictive, abstinence from nicotine produces withdrawal symptoms that present a barrier to quitting. However, evidence from settings in which tobacco abstinence is mandatory, such as military training or prisons, suggests that withdrawal symptoms may be ameliorated in such settings.<sup>23</sup> Smoking behavior is modified to a substantial degree by environmental cues that become associated with smoking, such as eating or alcohol consumption.<sup>24</sup> Withdrawal symptoms may be accentuated in the smoker's natural environment, perhaps because these smoking-related cues elicit withdrawal symptoms. When the smoker's environment is modified, such cues may not be operative, and withdrawal symptoms may be lessened. Recent data suggest that smokers who are abstinent in the postoperative period generally do not experience serious withdrawal symptoms.<sup>22</sup> Furthermore, the changes in perceived stress that accompany surgery are not different in smokers and nonsmokers. Thus, abstinence from cigarettes in the perioperative period does not contribute to psychological stress in surgical patients.

A recent clinical trial illustrates the potential long-term benefits of smoking cessation after elective surgery.<sup>25</sup> Rup-

ture of abdominal aortic aneurysms may be fatal, although many smaller aneurysms never rupture. However, surgical repair of the aneurysm is also risky. Thus, for small aneurysms, the dilemma is whether they should be repaired immediately or whether surgeons should wait until the aneurysm shows signs of enlarging. That trial randomized approximately 1000 patients either to undergo immediate repair or to wait until their aneurysm reached a certain size. Many of these patients were current smokers. Early (1-year) survival was less in patients undergoing immediate repair because of mortality associated with surgery. However, at 8 years, survival was significantly improved in patients undergoing early surgery. This benefit was not due to more ruptured aneurysms in the group that did not undergo early surgery. Rather, those patients who underwent immediate surgery were more likely to quit smoking and were thus less likely to experience the consequences of smoking-related disease (such as myocardial infarction). In other words, immediate surgery was beneficial to long-term survival, not because of any direct benefit of surgical repair but because surgery prompted patients to quit smoking. This important trial suggests that effective tobacco interventions could benefit the long-term health of the estimated 8 million smokers who undergo surgical procedures annually in the United States. The challenge is how providers involved in the surgical process can best take advantage of the teachable moment represented by surgery.

### HELPING SURGICAL PATIENTS QUIT SMOKING

Although smoking cessation is extremely difficult, millions of people have done so. Effective interventions are now available to help those who want to quit smoking. Practice recommendations based on expert panel opinion and meta-analysis of available studies provide clear guidance to primary care physicians.<sup>26</sup> The elements of brief tobacco interventions have been codified as the "5 A's"

(Table 1) according to the Clinical Practice Guideline for Treating Tobacco Use and Dependence (available at [www.surgeongeneral.gov/tobacco/](http://www.surgeongeneral.gov/tobacco/), accessed September 16, 2004). These elements can serve as the framework for interventions directed specifically toward the patient scheduled for elective surgery; however, they should be tailored to meet the unique needs and opportunities presented by each surgical patient.

#### ASK ABOUT TOBACCO USE

Although the Clinical Practice Guideline already recommends that systems be implemented so that every patient is queried about tobacco use status at every visit, this is especially vital in presurgical patients because their smoking behavior may have immediate consequences. This sense of urgency should carry forward into the other steps in the process.

#### ADVISE TO QUIT

The Clinical Practice Guideline recommends that advice for smoking cessation be clear, strong, and personalized. The scheduling of surgery provides a unique opportunity to immediately customize and personalize this advice by reference to the upcoming surgical event. *All* patients should be strongly advised to abstain from smoking from at least 12 hours before surgery to at least 1 week after surgery. In most settings, this preoperative “fast” from cigarettes can be achieved by not smoking after awaking in the morning—much like patients are already told not to eat in the morning. The rationale for at least some period of preoperative abstinence is to allow for the dissipation of carbon monoxide before the induction of anesthesia. The rationale for the period of postoperative abstinence is to allow the initial phase of wound healing to progress in the absence of exposure to cigarette smoke. To support this recommendation, 3 messages should be communicated: (1) because patients cannot smoke while in the surgical facility, some period of fasting from cigarettes is mandatory; (2) smoking increases the chances of complications during and after surgery, and maintaining a fast from cigarettes for at least the minimum recommended period will reduce patients’ risk of complications; and (3) symptoms of nicotine withdrawal generally are not a problem when patients quit smoking about the time of surgery. Simple educational materials directed specifically toward surgical patients may be useful to communicate these messages (Figure 1).

#### ASSESS WILLINGNESS TO MAKE A QUIT ATTEMPT

The Clinical Practice Guideline recommends differing actions based on whether a patient wants to make a quit attempt. However, surgical patients do not have an option

### Stop Smoking for Surgery

**Why quit for surgery?**  
 Decreases your chances of problems during surgery  
 Helps you heal faster after surgery  
 Helps prevent complications after surgery, such as  
     Pneumonia  
     Heart trouble  
     Wound infections

**What should you do?**  
 Set a quit date right now  
 Stop smoking at least 12 hours before surgery (or longer!)  
 Use nicotine gum instead of smoking the morning of surgery  
 Stay smoke free for *at least* 1 week after surgery

**Want to stay smoke free for life?**  
 It is tough to quit, but surgery is a great time to try because  
     You cannot smoke while in the surgical facility  
     Most people are free of cravings right after surgery  
     You may be more motivated to change your lifestyle

**How can you get help?**  
 Ask us; we will help you!  
 Make a telephone call to a quitline; ask us for the number  
 Use the Web—[www.smokefree.gov](http://www.smokefree.gov)

FIGURE 1. Example of educational materials that can be distributed to preoperative patients.

regarding whether to abstain from cigarettes; the question is for how long. The clinician should determine whether the patient is willing to attempt to quit smoking permanently now or about the time of surgery, ie, extend their requisite perioperative abstinence. Patients should be advised that if they have considered quitting smoking (and most smokers plan to quit in the future), surgery is an excellent time to do so; in addition to the reasons listed previously, patients can be advised that their chances of successful smoking cessation increase near the time of surgery (Figure 1).

#### ASSIST IN QUIT ATTEMPT

The Clinical Practice Guideline provides several recommendations for assisting quit attempts, including devising an individual quit plan with the patient, providing practical counseling, helping the patient obtain social support, and providing supplementary materials (Table 2). All these steps may be useful for the surgical patient and again may be tailored to the perioperative setting. For example, patients typically activate social support mechanisms in the perioperative period; these mechanisms can be used to assist smokers in maintaining abstinence. Also, various specialist resources are available, including telephone “quitlines” (see [www.smokefree.gov](http://www.smokefree.gov), accessed October 12, 2004) and tobacco treatment specialists who can provide assistance before, during, and after hospitalization.



TABLE 2. **Assisting the Patient in Quitting**

Action	Strategies
Help with a quit plan	Set a quit date Tell family and friends Anticipate challenges Remove tobacco from environment
Provide skills	Encourage total abstinence Discuss past quit attempts Address potential challenges Get housemates not to smoke
Obtain social support	Supportive clinical environment Enlist spouse/friends
Provide supplementary materials	Provide multiple sources* Customize for surgical patients†
Refer to more intensive intervention	Recommend nicotine treatment centers Recommend telephone "quitlines"*

\*See [www.smokefree.gov](http://www.smokefree.gov) for resources.

†See Figure 1 for example of customized supplementary materials.

Several effective pharmacotherapies are available to treat tobacco dependence, including products that deliver nicotine and the antidepressant bupropion (Table 3). Use of these products will approximately double the rate of successful quitting in the outpatient setting. Nicotine replacement therapy (NRT) is well tolerated and has a documented record of safety, even in patients with cardiovascular disease.<sup>5</sup> Several forms, including nicotine gum, patches, and lozenges, are available without a prescription in the United States. However, concerns have been expressed regarding the safety of NRT for surgical patients. These concerns arise primarily from the fact that smokers are at increased risk of impaired healing of surgical wounds and bones.<sup>5,8</sup> To the extent that short-term exposure to nicotine is responsible for these findings, NRT may increase the risk of such complications. Prolonged exposure of experimental animals to high doses of nicotine can impair the healing of

surgical wounds.<sup>9</sup> However, no studies have used doses of nicotine comparable to those provided by NRT. Also, these experiments do not compare the effects of nicotine with the effects of continued smoking. Data in human subjects are limited. An important recent investigation studied experimental wounds in smokers.<sup>17</sup> One group continued smoking, 1 group quit smoking without using NRT, and 1 group quit with use of NRT. Abstinence from smoking substantially decreased the rate of wound infection, whether or not NRT was used. This study supports the idea that the use of NRT does not affect the benefits of abstinence from smoking for decreasing postoperative wound complications. Considering that, in the absence of intervention, most smokers resume smoking immediately after discharge from the surgical facility,<sup>22</sup> NRT should be considered a tool to help surgical patients maintain abstinence before and after surgery.

The best methods for using pharmacotherapy for the surgical patient remain to be determined. If patients are willing to make a quit attempt at least weeks before surgery, bupropion can be used because drug therapy needs to begin 1 to 2 weeks before the quit date. Any of several delivery methods for NRT would be appropriate. If patients are willing to abstain only temporarily or set a quit date coincident with the surgical date, products such as nicotine gum or lozenges may be useful on the morning of surgery to assist in maintaining the preoperative fast from cigarettes. Data suggest that use of NRT in hospitals is not routinely necessary to treat withdrawal symptoms,<sup>22</sup> but this may be an excellent setting in which to initiate NRT under the guidance of health care providers.

#### ARRANGE FOR FOLLOW-UP

With few exceptions, all surgical patients will be seen by their surgeon postoperatively, providing at least 1 "auto-

TABLE 3. **Pharmacotherapy for Tobacco Dependence\***

Product	Typical dose	Available OTC
Nicotine gum	2 mg for those smoking up to 25 cigarettes/d; 4 mg for those smoking >25 cigarettes/d	Yes
Nicotine lozenge	2 mg if time to first cigarette in the morning is >30 min; 4 mg if time to first cigarette in the morning is <30 min	Yes
Nicotine nasal spray	1 mg, 1-2 times/h initially	No
Nicotine inhaler	1 cartridge = 4 mg nicotine, 6-16 cartridges/d	No
Nicotine patches	OTC: 21 mg/24 h or 15 mg/16 h; prescription: various doses	Some forms
Bupropion	150 mg each morning for 3 days, then 150 mg twice daily. Begin more than 1 week before quit date	No

\*OTC = over the counter.

matic" opportunity for follow-up regarding their efforts to remain abstinent from smoking. This follow-up can be coordinated with the primary caregiver to ensure that support for abstinence is provided in accordance with Clinical Practice Guideline recommendations. If at the preoperative visit the patient expressed a willingness to make a permanent quit attempt, a separate postoperative visit with the primary caregiver specifically to address tobacco behavior should be arranged. Even if abstinence has not been maintained, it may be possible to build on the experience of temporary perioperative abstinence to assist future quit attempts.

## SUMMARY

The perioperative period provides a unique opportunity to intervene in cigarette smokers, which may improve immediate postoperative outcomes. Moreover, by exploiting the potential of surgery as a teachable moment, clinicians can substantially benefit the long-term health of their patients, a benefit that extends far beyond the perioperative period. Effective strategies require coordination between all involved in the surgical process, and such strategies are only beginning to be explored. However, primary care clinicians can play an important role now by recognizing that promoting abstinence from tobacco is a crucial step in preparing patients for elective surgery.

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## Questions About Preoperative Smoking Cessation

1. Smoking does not increase risk for which one of the following postoperative complications?
  - a. Pneumonia
  - b. Myocardial ischemia
  - c. Nausea and vomiting
  - d. Wound infection
  - e. Nonunion of fractured bones

2. Patients should quit smoking before surgery for at least which one of the following periods to maximally decrease the risk of postoperative pulmonary complications?
    - a. 1 day
    - b. 1 week
    - c. 2 months
    - d. 6 months
    - e. 1 year
  3. Which one of the following is not one of the “5 A’s” of brief tobacco interventions?
    - a. Ask
    - b. Advise
    - c. Assess
    - d. Assist
    - e. Abstain
  4. Which one of the following pharmacological aids to smoking cessation is available over the counter?
    - a. Bupropion
    - b. Clonidine
    - c. Nicotine gum
    - d. Nicotine nasal spray
    - e. Nicotine inhaler
  5. Which one of the following messages should not be communicated to smokers scheduled for surgery?
    - a. They cannot smoke in the surgical facility
    - b. They should try not to use NRT
    - c. Most people are free from cigarette cravings immediately after surgery
    - d. Around the time of surgery is a good time to quit smoking permanently
    - e. Quitting smoking will help prevent complications after surgery
- Correct answers:  
1. c, 2. c, 3. e, 4. c, 5. b

