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Tobacco control for anesthesiologists

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Abstract
Anesthesiologists daily witness the consequences of tobacco use, the most common preventable cause of death. Smoking-related diseases such as atherosclerosis and chronic obstructive pulmonary disease increase anesthetic risk, and even smokers without overt disease are at increased risk for morbidity such as pulmonary and wound-related complications. Evidence suggests that stopping smoking will reduce the frequency of these complications. Nicotine and the other constituents of cigarette smoke, such as carbon monoxide, have important physiologic effects that may affect perioperative management. In addition, it is now apparent that the scheduling of elective surgery represents an excellent opportunity for smokers to quit in the long term. This review serves as an introduction to tobacco control for anesthesiologists, first examining issues of importance to perioperative management. It then discusses how anesthesiologists and other perioperative physicians can help address tobacco use, both at an individual level with their patients, and by contributing to the implementation of effective public health strategies in their countries. Anesthesiologists can play a key role in helping their patients quit smoking. Effective tobacco control measures applied to surgical patients will not only improve immediate perioperative outcomes but also long-term health.

Key words Smoking · Cigarettes · Perioperative complications

Introduction

It is impossible to overstate the impact of tobacco use on global health. Worldwide, tobacco today causes approximately 1 in 10 adult deaths; by 2030 the figure is expected to be 1 in 6, or 10 million deaths each year. Of the approximately 6 billion people alive today, 500 million of them will eventually be killed by tobacco [1]. Half of these deaths will occur in people in middle age, depriving societies of their most productive workers and burdening healthcare systems. In every respect, cigarette use can be characterized as an epidemic [2]. In the early stages of the epidemic, the prevalence of cigarette smoking rises in the population, first among men, then among women, peaking at over 50% among males in most countries. Because there is a considerable time between smoking initiation and death from smoking-related diseases such as lung cancer, the rise in the death rate caused by smoking lags the rise in smoking prevalence by approximately 20 years. When effective tobacco control measures are applied, the prevalence of smoking begins to decline, first among men, then among women. However, smoking-related deaths continue to increase even after prevalence begins to decrease. In Japan, the prevalence of smoking among males has begun to decline, whereas the prevalence among females likely continues to increase; 47.4% of males and 11.5% of females smoked in 2000 [3]. Smoking rates among Japanese physicians are approximately half those of the general population: 27.1% of male and 6.8% of female physicians smoke cigarettes [4].

In addition to the responsibilities that anesthesiologists have as physicians to promote the health of their communities, smoking is also of direct concern to perioperative management. Smoking-related diseases such as atherosclerosis and chronic obstructive pulmonary disease increase anesthetic risk, and even smokers without overt disease are at increased risk for morbidity such as pulmonary and wound-related complications. Evidence suggests that stopping smoking will reduce the frequency of these complications [5]. Nicotine and the other constituents of cigarette smoke, such as carbon monoxide, have important physiologic effects that may affect perioperative management. In addition, it is now apparent that the scheduling of elective surgery represents an excellent opportunity for smokers to quit

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in the long-term [6,7]. For example, simply having a major surgical procedure at least doubles the chances that smokers will spontaneously quit [8]. Assistance from anesthesiologists and other healthcare providers has the potential to further increase these chances.

This review is meant to serve as an introduction to tobacco control for anesthesiologists. It will begin by briefly examining the effects of smoking on issues of importance to perioperative management. It will then discuss how anesthesiologists and other perioperative physicians can help address tobacco use, both at an individual level with their patients, and by contributing to the implementation of effective public health strategies in their countries.

Smoking and perioperative management

The effects of smoking on cardiac and pulmonary function are well known. However, of perhaps greatest significance to most patients are the effects of smoking on the healing of both surgical wounds and bones. Smoking status also affects many other facets of perioperative management, including pain perception. A more detailed review of the effects of smoking and acute abstinence from smoking specifically on physiology has been recently published [5].

Respiratory effects

Smoking is a major cause of respiratory disease, including chronic obstructive pulmonary disease and chronic bronchitis without overt airways obstruction [9,10]. Multiple mechanisms contribute to the pathophysiology, including chronic inflammation, epithelial damage, and alterations in immune function [11]. The functional consequences of these processes include an accelerated decrease in the forced expiratory volume in 1 s, decreased mucociliary clearance, and, in approximately 15% of smokers, chronic airways obstruction [9]. Quitting smoking will improve lung disease, although the recovery process may require weeks or months, and some structural changes may be irreversible [12].

Smoking increases the risk of perioperative pulmonary complications, even in those smokers without overt pulmonary disease [13–22]. Multiple mechanisms are likely involved, including impaired mucociliary clearance in the setting of excess mucus production [23,24]. Smoking exaggerates the normal decreases in macrophage function during prolonged anesthesia, potentially impairing immune defenses [25,26]. Abstinence from smoking will reduce risk, although it appears that several weeks of abstinence are necessary for maximal benefit, parallel to the time required for improvements in pulmonary function [16,21,22,27,28]. Some observational studies examining the association between the duration of abstinence and pulmonary complications have been interpreted as suggesting that quitting within a few weeks of surgery actually increases the rate of complications [21,22,27]. However, there is no firm evidence to support this interpretation [5,29]. Nonetheless, the longer the duration of preoperative abstinence, the better; it appears that at least 8 weeks of abstinence is required for maximal benefit. Children exposed to environmental tobacco smoke from their parents are also at risk for adverse respiratory events [30].

Regarding perioperative management, the clinical impression that smokers exhibit increased airway reactivity in the perioperative period is supported by some, but not all studies. For example, increases in pulmonary resistance and coughing caused by desflurane are enhanced in smokers [31,32], suggesting sensitization of reflex responses to chemical irritants in smokers. The response to bronchodilators is impaired in smokers, but smokers do not exhibit higher pulmonary resistance after endotracheal intubation compared with nonsmokers [33]. Surprisingly, intubated smokers also do not experience increased coughing during emergence from isoflurane anesthesia compared with nonsmokers [34]. Nonetheless, upper airway reflexes may be more sensitive in smokers [35].

Cardiovascular effects

Smoking is a major cause of cardiovascular disease, including coronary artery disease and peripheral vascular disease [36]. Mechanisms of injury are complex, but center on the promotion of atherosclerosis through endothelial injury, oxidant injury, adverse effects on blood lipids, and pro-thrombotic effects [37–39]. There are many smoke constituents that could be responsible for this injury, and the role of nicotine itself in promoting atherosclerosis is unclear [40]. Nicotine does increase sympathetic outflow and circulating catecholamine levels, which can increase myocardial oxygen demand [41]. Quitting smoking will significantly decrease the risk of death in smokers with coronary artery disease, reducing all-cause mortality by approximately one-third [42], so that tobacco control represents a very effective public health strategy to address cardiovascular disease.

The presence of smoking-related cardiovascular disease clearly increases the risk of perioperative cardiovascular complications [43]. The acute pharmacological effects of cigarette smoke may further increase risk. Patients without active symptoms of ischemic heart disease who smoked shortly before surgery develop more episodes of ST segment depression than nonsmokers, prior smokers, or chronic smokers who did not smoke before surgery [44]. Those patients with the highest expired carbon monoxide levels, an index of smoke expo-

sure, have the highest rates of ischemia. Carbon monoxide interferes with the carriage and delivery of oxygen, and may itself contribute to the risk of ischemia [45,46]. Patients who smoke experience exaggerated hemodynamic responses to endotracheal intubation [47,48]. Thus, in addition to considering the possible impact of smoking-related cardiovascular disease, anesthesiologists must determine how best to manage the acute pharmacological effects of smoke constituents such as nicotine and carbon monoxide in the perioperative period. Even relatively brief abstinence will significantly decrease plasma concentrations of these and other smoke constituents, and thus may improve cardiovascular outcomes [5].

Wound and bone healing

For many surgical procedures, smokers are at greater risk to develop wound-related complications such as wound dehiscence and wound infection [49–52]. Smoking also increases the risk for nonunion of spinal fusions, and may retard the healing of fractures [53–58]. Several mechanisms may contribute to risk. The partial pressure of oxygen in tissues is an important determinant of healing [59,60]. Smoke constituents such as carbon monoxide, which impairs oxygen carriage and delivery, and nicotine, which causes peripheral vasoconstriction, may decrease tissue oxygenation [61–63]. Smoke constituents may also affect the function of cells such as fibroblasts and osteoblasts that are important to healing [64–68]. The role of nicotine in mediating these actions is not known. In animal models, nicotine in high doses (considerably higher than those achieved in human smokers) can impair wound healing [69,70]. These effects of nicotine itself either are equivocal or not present in animal models of bone healing [57,71–73]. Finally, the microvascular disease produced by chronic smoking itself may contribute to impaired healing.

Abstinence from smoking can reduce the rate of wound-related complications. The best evidence comes from a trial that randomized smokers scheduled for lower-extremity total joint replacement to receive either usual care or a stop-smoking intervention that included nicotine replacement therapy, beginning approximately 2 months before surgery [74]. The rate of wound infection was dramatically decreased in those patients who quit smoking, significantly reducing the total costs associated with hospitalization [75]. An experimental study utilizing punch biopsies in healthy smokers and nonsmokers found that as little as 4 weeks of abstinence reduced the rate of wound infection in smokers to that in nonsmokers [76]. Observational studies also demonstrate that preoperative abstinence seems to reduce the rate of wound-related complications [49,77]. The duration of abstinence necessary for benefit remains to be defined. If risk is mediated by the acute pharmacologic effects of smoke constituents such as nicotine and carbon monoxide, even brief preoperative abstinence should be beneficial. Less information is available regarding the effects of preoperative smoking abstinence on bone healing; continued smoking after surgery increases the rate of nonunion following spine surgery [53].

Nervous system effects

Nicotine is delivered in relatively high concentrations to the central nervous system almost immediately after the inhaling of cigarette smoke, accounting in large measure for the addicting properties of cigarettes [78]. Nicotinic receptors have multiple roles in the central and peripheral nervous systems [79]. The function of these receptors is significantly altered by chronic exposure to nicotine [80]. Smoking-induced alterations in the neurobiology of the brain have several implications for anesthesia.

Withdrawal from nicotine can produce a variety of somatic and affective symptoms that can appear within hours and may last for weeks [80]. Somatic symptoms may include increased appetite, headaches, sweating, and others, and prominent affective symptoms include anxiety, irritability, difficulty concentrating, depression, fatigue, and many others [81–83]. Treatment of these symptoms is one key to the effectiveness of nicotine replacement therapy as an aid to stop smoking. Abstinence from smoking in the perioperative period could produce nicotine withdrawal symptoms and contribute to the considerable stress that the surgical patient already must endure. However, recent studies show that surgical patients who are abstinent from smoking do not consistently report nicotine withdrawal symptoms, and do not experience higher levels of psychological stress induced by surgery compared with nonsmokers [8,84]. Thus, it appears that other factors associated with surgery, such as the use of opioid analgesics, may mitigate nicotine withdrawal symptoms. This finding suggests that the perioperative period may be an excellent opportunity for smokers to attempt sustained abstinence, and that routine nicotine replacement therapy for the purpose of treating withdrawal symptoms is not necessary in surgical patients.

Anesthetic requirements may be altered in smokers. Both isoflurane and propofol inhibit neuronal nicotinic receptors in mice, suggesting that, in turn, nicotine could affect anesthetic requirements [85]. Indeed, nicotine (but not other nicotinic agonists) causes a small but significant decrease in the minimum alveolar concentration (MAC) in mice [86]. On the other hand, smokers require higher doses of propofol to achieve a given level of sedation, although it is not clear if this is related to

effects of smoking on propofol pharmacokinetics, pharmacodynamics, or both [87]. Of note for the monitoring of these patients, awake values for the bispectral index (BIS) appear to be greater in smokers than nonsmokers, and a lower BIS value is required to achieve a given level of clinical sedation [87].

Smoking affects pain perception, although these effects are complex and extant studies are often not consistent. In general, smoking a cigarette increases thresholds to painful stimulation in experimental settings [88–91]. Nicotine administered to nonsmoking surgical patients shortly before emergence from anesthesia decreases pain scores and morphine utilization [92]. Smokers require increased opioid doses after a variety of surgical procedures, including coronary artery bypass grafting [93], oral surgery [94], and pelvic surgery [95]. Again, it is not clear whether this finding is caused by differences in opioid pharmacokinetics, pharmacodynamics, or both, and more studies are needed. Interestingly, smoking status is a risk factor for many chronic pain states [96–98]; it is not known how abstinence affects chronic pain, although an anecdotal report suggests improvement [99].

Other effects

Smoking is a protective factor against the development of postoperative nausea and vomiting (PONV) [100–105]. The salient mechanism is not known. Although smoke constituents such as carbon monoxide may promote bowel motility and thus ameliorate nausea [106], the rate of PONV is not correlated with recent exposure to cigarette smoke, as quantified by exhaled carbon monoxide levels, such that this protective effect is unlikely to be related to an acute pharmacologic effect of smoke constituents [107]. As discussed above, prolonged exposure to nicotine profoundly changes brain nicotinic receptor function [108], changes which apparently include tolerance to the acute emetic effects of smoke constituents [104,109]. This tolerance may extend to factors producing PONV.

The constituents of cigarette smoke also affect drug metabolism. For example, smoke constituents induce some of the cytochrome P450 pathways [110–112], including CYP1A2 and CYP2E1, which are responsible for the metabolism of several drugs used during anesthesia (including volatile anesthetics [113]). Such differences in metabolism could contribute to the protective effects of smoking on PONV [102]. Serum inorganic fluoride levels are increased postoperatively in smokers compared with non-smokers, without causing detectable changes in renal function [114]. Potential effects on opioid metabolism that could affect the management of postoperative analgesia have not been examined.

Smoking status may affect the clinical use of neuromuscular blocking drugs. Smokers who maintain abstinence preoperatively require a smaller maintenance dose of atracurium than nonsmokers [115]. Those who continued to smoke until surgery, or received nicotine replacement therapy, had dose requirements similar to those of nonsmokers. Other studies have reported a greater requirement for vecuronium in smokers [116], and no differences between smokers and nonsmokers in requirements for rocuronium [117]. The mechanisms responsible for these observations are not known.

Approaches to tobacco control

There are many effective measures to control tobacco use, ranging from public policy measures such as bans on cigarette advertising, prohibitions on workplace smoking, and increased taxes on cigarettes, to the treatment of individual smokers by means of counseling, pharmacotherapy, and other measures [118]. The primary barriers to the effective use of these measures are political and economic rather than practical. Because anesthesiologists daily see the devastating consequences of tobacco-related disease, anesthesiologists should join with other healthcare professionals to become effective advocates for tobacco control at every level [6]. There are unique challenges facing tobacco control in Japan, but there are also unique opportunities for anesthesiologists and other perioperative physicians to participate in a burgeoning tobacco control effort. This section provides the background of tobacco control efforts in Japan, a review of effective public policy measures that can reduce smoking prevalence, and specific methods that physicians and healthcare systems can use to help individual smokers quit (Fig. 1).

Tobacco control in Japan

Although tobacco was introduced into Japan by the Portuguese in the sixteenth century, as in other countries, the widespread adoption of cigarette smoking was stimulated by the development of modern manufacturing methods to produce mass quantities of cigarettes [119]. At the beginning of the twentieth century, the Japanese government created a national monopoly of tobacco processing and sale to profit from the increased popularity of cigarettes. In 1985, control was transferred to a private corporation (Japan Tobacco, Inc.) to enhance its economic growth [120]. However, the Japanese government is still the major shareholder in this corporation. In 1987, in response to pressure from American tobacco companies, aided by the United States government under the guise of promoting "free trade", tariffs were removed from the import of

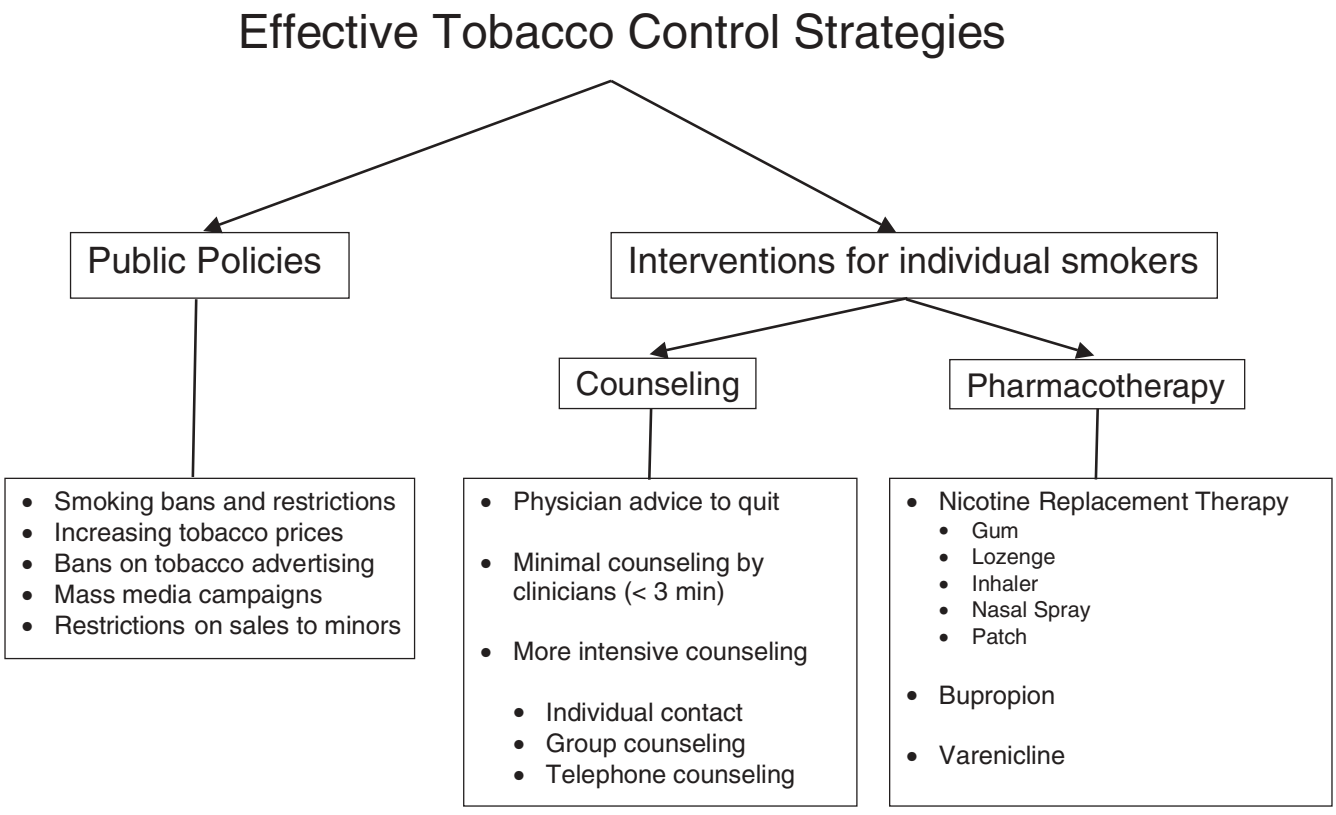

Fig. 1. Summary of effective tobacco control strategies

tobacco, triggering an explosion of marketing activities [121]. As a result, the prevalence of smoking among the young and women increased in subsequent years, reflected in a reversal of a downward trend in previous years in both total and per-capita cigarette consumption [120].

As reviewed in the following section, there are effective public policy measures that can reduce tobacco use. However, as recognized by Japanese public health workers, there is an inherent conflict of interest created by government ownership of Japan Tobacco that has limited the activity of the national government in controlling tobacco [119]. Furthermore, as in every other country, tobacco companies pursue aggressive marketing strategies, without regard for the health of their potential customers, and actively oppose public policy measures designed to control the use of tobacco. Nonetheless, there is an increasingly active tobacco control movement in Japan, and a growing literature specific to Japanese efforts [119]. The World Health Organization has developed and endorsed the Framework Convention on Tobacco Control, which serves as a comprehensive roadmap for tobacco control policy development, enhancement, and implementation (http://www.who.int/tobacco/framework/en/; accessed September 16, 2006). Japan accepted the provisions of the Framework Convention in June of 2004. The Framework Convention represents an important step forward in international efforts to control tobacco, but is also illustrative of the ongoing influence of tobacco companies. For example, governmental influences significantly weakened the language of the Convention to protect the economic well-being of tobacco companies [122], and similar influences have prevented the ratification of the Convention by key countries such as the United States (as of September 21, 2006).

Public policies to control tobacco

Although the efforts to help individual smokers quit are an important component of the response to the tobacco epidemic, undoubtedly the most efficient measures are relatively simple changes in public policies. There is now a considerable evidence base to document this effectiveness [118]. As advocates for public health, physicians have an important role to play in the development and implementation of these policies.

Smoking bans and restrictions are policies and laws that limit smoking in public areas. The rationale is to protect the public from the adverse effects of environmental tobacco smoke (or "second-hand smoke"), which exposes nonsmokers to the hazards of smoke

constituents. The consequences of such exposure range from increasing middle ear infections in infants and children, to exacerbation of asthma and lower respiratory tract infections, to an increase in cancer deaths. A recent report from the United States Surgeon General conclusively outlines these risks [123]. There is strong evidence that smoking bans and restrictions reduce exposure to environmental tobacco smoke [118]. It is also likely that these bans reduce tobacco consumption and encourage cessation. Smoking bans in healthcare facilities deserve special mention. In addition to the practical benefits of reducing the exposure of patients and staff to environmental tobacco smoke, such bans can send an important message regarding the health effects of smoking [124].

Control of the sales and marketing of tobacco products is also of importance. *Increasing the price of tobacco products* through taxation significantly reduces tobacco use, prevalence, and consumption. *Regulation of tobacco packaging* to include warning labels that clearly and graphically describe the hazards of smoking also is effective. The tobacco industry heavily promotes the use of their products. This marketing, which may take the form of direct advertising, indirect branding, or sponsorship of athletic or musical events, is quite effective, as indicated by the enormous sums expended by these companies. *Bans on tobacco advertising, promotion, and sponsorship* deprive the tobacco companies of these marketing tools and reduce the prevalence of tobacco use. Counter-marketing can also be used as a positive influence to decrease tobacco use. *Mass media campaigns*, using modern marketing techniques, have proved quite effective, especially when directed towards adolescents and young adults. Because the majority of smokers begin using tobacco during adolescence, *restrictions on sales to minors* are another important step to reduce smoking initiation.

Methods to help smokers quit

It is very difficult to stop smoking. Without assistance, the spontaneous rate of quitting in a general population of smokers is low (generally <5% annually), and multiple attempts will be necessary for most to be successful [125]. Nonetheless, after decades of concerted tobacco control efforts in the United States, there are now more ex-smokers than current smokers, and the majority of current smokers want to quit [126]. It appears that approximately 25% of Japanese smokers wish to quit [119]. In addition to the important public health measures described in the previous section, there are effective means that can be applied to individual smokers to help them quit [125]. These include both counseling of individual smokers and pharmacotherapy to alleviate the symptoms of nicotine withdrawal [127]. These measures are highly cost-effective, as the cost to provide these services to smokers is far less than the economic consequences of continued smoking, in terms of lost productivity and the medical expenses incurred to treat smoking-related illness [75,128]. Recent efforts have also concentrated on the responsibility of all healthcare providers to help their patients quit smoking. For example, healthcare systems can be structured to ensure that these measures are consistently applied when patients contact these systems [125]. Measures directed specifically at surgical patients can be effective [129–134], although much more work is needed to devise strategies that are specifically designed to meet the needs of these patients and surgical providers.

Counseling

A wide variety of counseling methods have been evaluated, ranging from brief advice from a physician to stop smoking, to multiple sessions provided by trained counselors in dedicated clinical settings [125]. Advice from physicians to stop smoking produces a small but significant increase in quit rates, even without other interventions. For this reason, *all* physicians should advise *all* smokers to quit during *every* encounter. If clinicians spend even just a few additional minutes in providing counseling, the rate of quitting is further increased. The more time spent, the greater the rate of success, with maximal efficacy observed at approximately 90 min of counseling. Many forms of counseling are effective, including group counseling and individual counseling. Counseling can also be effectively provided via telephone or the internet. Elements of effective interventions include providing practical problem-solving skills, helping the patient obtain social support (e.g., from a spouse), providing supplemental materials (e.g., brochures, etc.), and developing a personalized quit plan that includes a target quit date. Follow-up after an initial counseling session may be important to provide further encouragement for those smokers who have not yet quit, and to assist those who have quit in their efforts to maintain abstinence.

Pharmacotherapy

One barrier to maintaining abstinence from cigarettes is the symptoms of nicotine withdrawal, such as cravings for cigarettes [81,135]. Two classes of medications are currently widely used to promote abstinence by helping to alleviate these symptoms; both will approximately double the rate of success in quitting smoking, and new categories of medications are under development [136,137].

Nicotine

Nicotine can be administered by a variety of methods, including gum, inhalers, lozenges, nasal spray, and patches. Although the pharmacokinetics of nicotine delivery differ widely among these methods, all aim to deliver a relatively sustained plasma level of nicotine that will lessen the symptoms of nicotine withdrawal. Each method of delivery has advantages that may be attractive to different patients; each method will approximately double quit rates [125,138–140]. For example, nicotine patches have the convenience of once-daily dosing. However, some smokers wish to more precisely regulate nicotine levels over the course of a day, and find the tactile sensations provided by gum or lozenges to be helpful in replacing cigarettes.

Nicotine replacement therapy has proved to be remarkably safe [141]. Although there were early concerns regarding its use in patients with cardiovascular disease, subsequent studies have conclusively demonstrated that nicotine replacement therapy can be safely used in patients with coronary artery disease, even if they continue to smoke [142–144]. Because smokers are already habituated to effects such as nausea, these side effects are usually not an issue.

Few studies have investigated the safety and efficacy of nicotine replacement specifically in surgical patients. Nicotine gum increases the volume of gastric contents, but by a small amount that is unlikely to be clinically significant [145]. Nicotine replacement therapy exaggerates the hemodynamic response to endotracheal intubation, but again by a relatively small amount [146]. Perhaps the greatest potential concern is the potential effects of nicotine on wound and bone healing. As reviewed above, healing is impaired in smokers, but the role of nicotine itself in this effect is uncertain. Animal studies examining the effects of nicotine on wound healing have generally employed doses of nicotine far greater than those used for nicotine replacement in humans [69,70]. An important study in human subjects, utilizing experimentally induced wounds (punch biopsies), showed that, in smokers, abstinence from cigarettes dramatically reduced the frequency of wound infections to approach that in nonsmokers [76]. This dramatic improvement was also observed in smokers who maintained abstinence with the assistance of nicotine replacement therapy, suggesting that other constituents of cigarette smoke, not nicotine, cause wound-related complications. A recent placebo-controlled trial of nicotine replacement therapy in surgical patients who smoke found that surgical complications were not increased in patients receiving nicotine [84]. Thus, although more study is required, current evidence suggests that nicotine replacement therapy should be safe in surgical patients. There is little doubt that nicotine replacement therapy is far preferable to continued smoking, which exposes patients to all the other constituents of cigarettes smoke.

Bupropion

Like nicotine replacement therapy, this antidepressant will also approximately double the rate of successful quitting [125,136,137]. It is usually administered beginning 2 weeks prior to a target quit date. It has the advantage of completely eliminating exposure to nicotine, and is generally well tolerated. One small study has shown that bupropion can reduce preoperative cigarette consumption in surgical patients, but does not increase the quit rate [147].

New agents

Several new agents to assist smokers in quitting are either under development or newly released. Varenicline is a partial agonist at the $\alpha_4\beta_2$ nicotinic acetylcholine receptor, and has recently been approved in the United States for the treatment of nicotine dependence [148,149]. Because of its nature as a partial agonist, it may serve to both treat the symptoms of nicotine withdrawal, and to block the pleasurable effects of nicotine provided by smoke if cigarettes are consumed. In initial clinical trials, it has proved highly efficacious [150–152]. Rimonabant is a CB1 cannabinoid receptor antagonist originally developed to treat obesity, and is currently available in the United Kingdom for this indication. However, initial trials suggest that it may also be efficacious in treating nicotine dependence [148]. Because weight gain commonly accompanies abstinence from tobacco, the potential of rimonabant to ameliorate this effect is an attractive feature. A nicotine vaccine is under development that may inhibit the pleasurable effects of nicotine [153].

Role of anesthesiologists in tobacco control

Anesthesiologists have a unique opportunity to contribute to tobacco control [6]. As perioperative physicians, anesthesiologists can serve as effective advocates for tobacco control policies in their hospitals and communities. At the level of the individual smoker, the possibility of improved perioperative outcomes provides an excellent rationale to encourage smokers to maintain at least temporary abstinence. In addition, surgery may focus the attention of smokers on their health and make them more receptive to messages about stopping smoking. Although the time available for counseling may be limited, and few anesthesiologists have training in tobacco control, there are simple steps that every anesthesiologist can take.

Stop smoking

Every physician who smokes should quit. Physicians cannot be effective advocates for tobacco control if they themselves are still addicted to cigarettes. Evidence shows that physicians are less likely to implement tobacco control measures in their practices if they themselves smoke [154,155]. In countries with more mature tobacco control programs, physician smoking rates are less than 5% [156,157]. Physicians should also be active in helping other healthcare professionals, such as nurses [161], quit smoking.

Promote smoking bans in healthcare facilities

Smoking bans in public facilities in general, and in healthcare facilities in particular, have proven to be a very effective tobacco control measure. Some countries have established requirements that all healthcare facilities ban smoking [124]. In addition to providing a more healthy environment for both employees and patients, employees in smoke-free hospitals are more likely to stop smoking [158–160]. Although the implementation of these bans is not without challenges [161], once established they are well accepted by both patients and staff. Physicians should be active in working with hospital leadership to advocate for smoking bans in their hospitals and other healthcare facilities.

Help individual smokers

Based on the best evidence available, the United States Public Health Service has recommended five steps that physicians should implement to help their patients quit smoking: *A*sk about tobacco use, *A*dvise to quit, *A*ssess willingness to make a quit attempt, *A*ssist in a quit attempt, and *A*rrange follow-up [125]. Because anesthesiologists in general have limited time available with each patient, and limited knowledge of tobacco control techniques, it is not practical to expect them to implement each of these steps. However, anesthesiologists can still implement some of them.

Ask

Anesthesiologists should consistently ask their patients about their tobacco use as a part of the preoperative interview, including the time of last tobacco use. To help ensure that this history is consistently obtained, all medical records used to document preoperative evaluation should have a consistent method for identifying current and past tobacco use, which should be viewed as another "vital sign".

Advise

Every patient who smokes should be strongly urged to quit for as long as possible before surgery. There are several messages unique to the preoperative setting that can be delivered. Because continued smoking may increase the risk of perioperative complications, patients can be advised that stopping smoking, even temporarily, may help them recover from surgery. This message applies even to those patients who do not plan to maintain extended perioperative abstinence. Just as all patients are asked to abstain from food the night before surgery, all smokers should be asked to "fast" from cigarettes beginning the evening before surgery [6]. Because of the relatively short half-life of smoke constituents such as nicotine and carbon monoxide, this should help reduce their impact on perioperative management. In the absence of such advice, almost all smokers continue to smoke until immediately before hospital admission [8,84]. Finally, for those patients willing to make an extended quit attempt, they can be reassured that they likely will not experience significant nicotine withdrawal symptoms while in the hospital [8,84].

Assist

During a brief preoperative visit, there may be limited opportunities to provide direct assistance in the form of more extended counseling and pharmacotherapy. However, each anesthesiologist should be familiar with whatever local resources are available for the treatment of tobacco dependence. If patients are seen in a structured preoperative clinic, such services may be provided as a part of the preoperative evaluation process. For the patient who is hospitalized after surgery, their stay provides an excellent opportunity to provide tobacco interventions. Many studies have shown that a variety of interventions can help hospitalized smokers quit [129,132]. These can be provided by physicians, nurses, or trained counselors.

Conclusion

As perioperative physicians, anesthesiologists can play an important role in tobacco control efforts directed towards surgical patients, both by serving as advocates for changes in public policy (such as smoke-free hospitals) and by helping individual smokers quit. The extra effort will be rewarded by both improved perioperative outcomes for individual patients, and by improved public health of our communities.

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