Duration of Anesthesia as an Indicator of Morbidity and Mortality in Office-Based Facial Plastic Surgery

A Review of 1200 Consecutive Cases

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Objective: To define whether duration of anesthesia is an indicator of patient morbidity and mortality in facial plastic surgery performed in an accredited office-based surgical facility.

Design: A prospective and retrospective outcomes analysis of 1200 consecutive patients who underwent facial plastic surgery from July 1995 to February 2005. Outcomes of patients who underwent surgery with anesthesia for less than 240 minutes were compared with those of patients who underwent surgery with anesthesia for more than 240 minutes.

Results: Of the 1200 cases analyzed, in 1032 (86%), duration of anesthesia was longer than 240 minutes. There were no deaths and no cases of myocardial infarction or pulmonary embolism in this study group. Morbidity in the 1200 cases was reported as follows: 1 case of respiratory failure, 1 case of central nervous system deficit, 1 case of adverse reaction to medication, and 1 case that required transfer to a hospital. There were 6 cases of prolonged recovery from anesthesia. Incidences of major morbidity in the group of 168 patients (14%) whose anesthesia lasted less than 240 minutes were the same as in the group whose anesthesia lasted more than 240 minutes.

Conclusions: In an accredited office-based facial plastic surgery facility, anesthesia duration is not an indicator of patient morbidity and mortality. Combined facial plastic surgery procedures, using general anesthesia, can be accomplished safely in the office-based environment, and inpatient care would not have altered morbidity in this study group.

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The combination of improvements in surgical techniques, anesthetic medications, and anesthesia monitoring equipment has led to a progressive transition in the setting where surgery is performed. Initially, surgery was performed only in the hospital setting; then in the 1980s came the rise of the freestanding surgery center and the flourishing of ambulatory surgery. As outpatient surgery continued to increase in popularity, the next wave occurred in the 1990s with the advent of the office-based surgical facility.1,2 The growing demand for cosmetic surgery has had an impact on this trend. As of 2001, more than 50% of all cosmetic surgical procedures were performed in the office-based setting vs 25% in acute-care hospitals,3 and this percentage is continually increasing.4 Advantages offered by the office-based surgical facility include increased patient privacy, personalized care, convenience, control over scheduling, and significant cost reduction. In addition, the operative staff is familiar with the surgeon and his or her procedures and routines, which allows efficient and consistent patient care.5,6

Despite these advantages, office-based surgery has come under increased scrutiny after several well-publicized deaths occurred from procedures performed in office-based surgical facilities.7 There has been increased pressure from both the press and public for state regulatory agencies and medical boards to regulate and produce policies to govern office-based surgery.8

After 6 deaths related to office-based surgery were reported in Florida, in August 2000 the Florida Board of Medicine imposed a 90-day moratorium on level III office surgery (surgery performed with either general anesthesia or major conductance anesthesia, which involves deep levels of intravenous sedation).9 After the moratorium expired, permanent restrictions included prohibition of level III sur-
surgery for high-risk patients (physical status class 3, as defined by the American Society of Anesthesiologists [ASA]), prohibition of the combination of liposuction and abdominoplasty, limitation of the length of surgery to 8 hours, and requiring the reporting of all surgical procedures and the presence of an anesthesiologist for all level III procedures.

In 2002, the Federation of State Medical Boards adopted recommendations on policies for office-based surgery in areas such as administration, personnel, patient evaluation, anesthesia, accident reporting, facility accreditation, and liposuction procedures.

Multiple studies have proved the safety of office-based surgery and the use of general anesthesia when accomplished with appropriate anesthesia professionals in accredited facilities. This was further evidenced by Vila et al. in their highly publicized study, which was critical of office-based surgery. In their analysis of reported deaths in Florida, they revealed that only 38% of these facilities were accredited and in only 15% of these cases was an anesthesiologist present.

Although formalizing policies in many areas of office-based surgery is necessary to ensure that the appropriate standard of care is provided to the public, much debate exists about where inappropriate risk exists and what should or should not be regulated or restricted. Identification and incidence of risks is made more difficult by the scarcity of data available for regulators or advisory committees to use in order to avoid regulatory decisions based on anecdotal information. Balkrishnan et al. state in their article on the reporting of office-based surgery adverse events, “Although many states are drafting regulations for office-based surgery, the formulation of these policies is often not informed by published data on adverse patient outcomes resulting from these procedures.” Furthermore, they state, “In analyzing the data available to states as they attempt to impose regulations on office surgery, it is evident that sufficient data do not exist to formulate immediate evidence-based policy.”

Despite this statement, by 2005 most states were adopting or considering varied and differing rules and guidelines for office-based surgery, including Pennsylvania and Tennessee, which both imposed arbitrary 4-hour time limits on surgery duration.

Defining the risks and morbidity related to longer procedure duration, specifically in facial plastic surgery, has great significance because of the necessity to treat the aging face as a unit, thus appropriately combining multiple procedures. This approach is not only common but is recommended: Hamra states that most revision surgery is necessary because of the disharmonious appearance produced when portions of the aging face are treated and portions are left untreated. He further states that it is illogical to not combine certain facial cosmetic procedures.

Although data exist on the safety of office-based surgery in general, recommendations on combined procedures and surgery duration have been purely anecdotal. In addition, risks related to specific procedures have not been delineated from other procedure types. To our knowledge, there has not been a study that directly addresses and quantifies the risks and associated morbidity and mortality in procedures of longer duration (defined as more than 4 hours) combining multiple procedures in facial plastic surgery.

This study contains both retrospective and prospective case analyses. From July 1995 to March 2000, 492 cases were analyzed retrospectively; the remaining 708 cases were analyzed prospectively through February 2003. All surgical procedures were performed by board-certified surgeons in an office-based surgical facility in a private practice setting. Most of the procedures (1008) were performed by the same board-certified facial plastic surgeon (N.A.G.), exclusively using board-certified anesthesiologists. The office-based facility was accredited by the American Association for Accreditation of Ambulatory Surgical Facilities in November 1999.

More than 95% of surgical procedures performed were cosmetic facial procedures. Because 4 hours has been arbitrarily defined by some regulators as a time limit for duration of anesthesia in the office-based setting, 2 study groups were defined by duration of anesthesia: patients who underwent anesthesia that lasted longer than 240 minutes (hereafter, more than 240 group) and those whose anesthesia lasted less than 240 minutes (hereafter, less than 240 group). Case types differed in the 2 groups. In the more than 240 group, most of the cases were combined facial plastic surgery procedures for facial rejuvenation, such as rhinoplasties, blepharoplasties, brow lifts, and laser surgery to resurface skin. Rarely, oculoplastic or general plastic surgery procedures, such as abdominoplasties, breast augmentation, or canthoplasties, were combined with these procedures. The surgical procedures in the less than 240 group were mainly rhinoplasties, and the rest were isolated facial rejuvenation or general plastic surgery procedures.

General endotracheal anesthesia was used in most cases and exclusively in the more than 240 group. This anesthesia technique is based on use of intravenous propofol, midazolam, and fentanyl citrate augmented with nitrous oxide as an inhalation agent. Local infiltration of a 1:1 mixture of 1% lidocaine hydrochloride with 1:100,000 epinephrine bitartrate and 0.5% bupivacaine hydrochloride with 1:200,000 epinephrine is accomplished sequentially in the operative field throughout the procedure. A muscle-relaxing drug is used for induction of anesthesia and intubation but is seldom redosed during the procedure. In addition, patients routinely receive perioperative antibiotics, corticosteroids, and antiemetics. All patients undergoing procedures lasting more than 1 hour were thromboembolic disease support stockings, alternating leg pressure units over their lower legs, and had a urinary catheter in place, a Bair hugger full-body warming blanket (Warm Touch model; Mallinckrodt Medical Inc, St Louis, Mo), and extensive padding and cushioning of pressure points. Attention was placed on patient positioning before the induction of anesthesia and on the flexion or exercise of arms and legs intermittently during the procedure. Emphasis was also placed on eye care; lubricants and laser-resistant corneal shields are used during facial plastic surgery procedures.

Postoperatively, most patients in the more than 240 group were discharged from the surgical facility either to home or to a hotel accompanied by a health care professional. Patients were routinely evaluated the next morning after surgery.

Each case was analyzed by patient age, ASA physical status classification, duration of surgical procedure, and any associated morbidity and mortality. Specifically, morbidity and mortality incidences as defined by the Joint Commission on the Ac-
creditation of Healthcare Organizations criteria (death, myocardial infarction, cardiac arrhythmia, respiratory event, central nervous system deficit, and adverse reaction to medications) were determined. Additional morbidity specific to procedures of longer duration or outpatient setting, such as transfer to a hospital from the office-based surgical facility, prolonged recovery from anesthesia, integument injury, intractable pain, intractable nausea and vomiting, peripheral nervous system deficit, ocular injury, equipment failure, and return to the operating room, were also quantified. Incidences of these morbidity criteria were then compared with various previously published studies of either comparable plastic surgery or outpatient surgery in general.

**RESULTS**

The demographics of the 1200 cases analyzed were as follows: 86.5% of the patients were women and 13.5% were men. The average age of the entire study was 55.7 years (range, 5-84 years). The largest subgroup was patients aged 51 to 65 years (39.4%), with 11.8% of the study group being older than 65 years (Figure 1). Most of the patients were classified as either ASA 1 (38.4%) or ASA 2 (56.6%). In addition, 4.9% were classified as ASA 3 (Figure 2).

The average duration of surgery for the entire study was 306 minutes (range, 5-682 minutes) (Figure 3). The average duration of surgery in the more than 240 group was 406 minutes, whereas the less than 240 group had an average duration of surgery of 128 minutes (Figure 3). The more than 240 group encompassed 86% of the cases, and the remaining 14% comprised the less than 240 group (Figure 4).

Major morbidity outcomes are listed in Table 1. There were no deaths and no myocardial infarctions, cardiac arrhythmias, or pulmonary embolisms.

One adverse respiratory event occurred in the more than 240 group, a case of aspiration pneumonia secondary to an obstruction event on extubation, that occurred in a 59-year-old man (ASA 2), manifesting 30 hours after discharge and requiring inpatient admission and ventilatory assistance. The patient fully recovered and had no further sequelae.

One central nervous system deficit occurred in the more than 240 group, a cerebral hemorrhage that occurred in a 53-year-old woman (ASA 1), which manifested as prolonged emergence from anesthesia and required transfer to a hospital. A computed tomographic scan revealed the intracranial event. The patient then re-
required a second transfer to a tertiary care facility for further treatment. The etiology of the hemorrhage was undefined, and the patient is recovering from motor deficits without any hypoxic injury or cognitive deficits.

One adverse medication reaction, an anaphylactic reaction, occurred in the less than 240 group as a result of a previously unknown cephalosporin allergy in a 52-year-old woman (ASA 1) that manifested after intravenous infusion immediately after induction and intubation. The patient was resuscitated, stabilized, and extubated. She was discharged from the facility to her internist for precautionary evaluation and had no sequelae from the event.

Overall, 3 major morbidity events occurred, an incidence of 1:400 cases, or 0.25% (Table 2).

Minor morbidity events specific to either cases of greater duration or the outpatient setting were as follows.

There were no precautionary hospitalizations for intractable nausea and vomiting, intractable pain, or any other etiologies. No equipment failures occurred.

There were 3 integument complications (1:400). Each case was in the more than 240 group. Two cases involved minor soft tissue breakdown in the lower back or coccyx region. In both cases, the patients were in their early 40s (41 and 42 years old), ASA 1, and body builders with minimal body fat. The third case involved soft tissue breakdown of the heel in a 46-year-old patient (ASA 1), who developed a temporary footdrop from placement and use of an alternating leg compression unit. The second case was in a 39-year-old patient (ASA 1) who presented with temporary numbness related to ulnar nerve compression.

Prolonged recovery from anesthesia occurred in 6 cases (1:200). Five cases were in the more than 240 group, and 1 was in the less than 240 group. Two cases involved ASA 1 patients, and 4 cases involved ASA 2 patients. In 3 of these cases, the patients were being treated with selective serotonin reuptake inhibitors and were diagnosed as having serotonin syndrome (see the “Comment” section). All patients recovered without sequelae with general supportive care.

Ocular injury occurred in 12 cases (1:100), all cases of corneal abrasions. Three cases were ASA 1 patients; 8, ASA 2 patients; and 1, an ASA 3 patient. Ten cases were in the more than 240 group and 2 were in the less than 240 group. The most common link between these cases was prior blepharoplasty (9 patients). All cases resolved with administration of ocular lubricants and/or eye patching.

Two cases required a return to the operating room (1:600); 1 patient required drainage of a hematoma on postoperative day 1, and 1 patient required incision and drainage of an infection on postoperative day 7. Both patients were in the more than 240 group and were ASA 1.

Understanding the risks and the related morbidity and mortality of office-based surgery has been extremely difficult because of a lack of reporting of adverse events and overall outcomes data. In addition, because of a lack of standards, the data available are often contradictory and not procedure specific. Because of the publicity created by deaths in the office-based environment, state medical boards and government agencies have rushed to regulate office-based surgery despite a lack of data to support specific risk conclusions.

Potential morbidity exists in all surgical procedures performed anywhere. It is necessary to define the specific risks that exist in the office-based facility that would be prevented by performing a procedure either differently or in a different setting.

Although opinions have been expressed on the risks of combined procedures and procedures of longer duration in the office-based surgical facility, to our knowledge, no specific outcomes data to support any conclusion have been presented prior to this study.

In 2001, Hoefflin et al published outcomes of 23 000 consecutive plastic surgery procedures performed with general anesthesia in an accredited office-based facility and reported minimal morbidity and no mortality. Although certain combined procedures were routinely accomplished in their study, other major combined procedures were usually staged into 2 separate procedures. They did not reveal which cases were separated or the data, if any, that were used to support their decision.

It is essential to define when the greatest risks associated with general anesthesia exist to choose whether to stage specific surgical procedures. Although we are in
agreement with the conclusion of Hoeflin et al² that the risk of using general anesthesia is minimal and that it is clearly preferable in complex or extended procedures because of the safety provided by airway protection, a consistent level of anesthesia, and the ability of the surgeon to concentrate on the procedure, we must also note that it is our belief and the belief of many cardiologists (Robert LaBar, MD, written communication, September 15, 2004) that the critical period of vital sign instability and potential morbidity associated with general anesthesia is during intubation and extubation.

Facial plastic surgery, specifically facial rejuvenation, often necessitates combined procedures performed over longer durations to appropriately treat the aging face as a unit,¹³,¹⁴,¹⁷ thereby preventing the disharmonious appearance¹⁹ produced when portions of the aging face are treated and portions are left untreated. A staged procedure requires 2 intubations and extubations, which is appropriate if a combined or extended procedure creates risks and morbidity incidences that outweigh the risks associated with repeated intubation and extubation. The study by Hoeflin et al² does not define or quantify the scenario that creates the greater risks and the specific combined procedures with which they are associated.

The significance of avoiding generalized or anecdotal conclusions on the safety of combined procedures of longer duration is evidenced in a study by Fogarty et al,¹⁹ which compared 3 distinct types of reconstructive plastic surgery procedures, all lasting more than 6 hours, and which showed that different surgical procedures had markedly different morbidity rates and that surgical duration alone was not the major determinant of postoperative morbidity in these procedure types.

In a 2003 study addressing safety and efficacy in accredited office-based facilities, Byrd et al²⁰ evaluated 5316 consecutive plastic surgery cases, of which 10.2% were combination procedures. Although they reported minimal overall morbidity, 35 major complications, and no deaths, their data did not distinguish morbidity in relation to case duration or in combined procedures. In addition, any recommendations made or conclusions stated on combined procedures or procedures of longer duration were purely anecdotal: “The combination of multiple plastic surgery procedures during a single operation has the potential to increase complications.”²⁰ In referring to our study’s demographic data it is noted that 51.2% of the patients were older than 51 years and 11.8% were older than 65 years. Consistent with the findings of Becker and Castellano,²¹ who studied rhytidectomy outcomes in patients older than 70 years, major morbidity events did not exist in our patients who were older than 65 years.

Similar to the findings of Morello et al²² in their survey study of patient safety in accredited office surgical facilities (analyzing 400,675 procedures, most [1141 [95.1%]] of our surgical cases were ASA 1 or ASA 2 patients. We had no major morbidity events in the 59 procedures (4.9%) performed on ASA 3 patients. This is significant, considering the restrictions placed on performing surgery on ASA 3 patients in the office-based facility in some states, such as Florida.⁹ Although we do not advocate routinely performing procedures on ASA 3 patients, there are some conditions that can classify a patient as ASA 3 but that have minimal associated morbidity risks in facial plastic surgery. We emphasize that these potential patients can be operated on safely only if they are diligently prescreened and appropriately defined on a case-by-case basis, using medical consultations specific to internal medicine, anesthesia, and comorbidity.

Our study evaluated 1032 surgical procedures in which anesthesia lasted more than 240 minutes; to our knowledge, this is the largest study analyzing morbidity and mortality in consecutive cases of anesthesia of long duration. These cases were predominately combined facial rejuvenation procedures, and their average length was 406 minutes. Procedures in the less than 240 group were predominately rhinoplasties. There were no deaths in our study. There were 3 cases of major morbidity. 2 in the more than 240 group (1.516 procedures [0.19%]) and 1 in the less than 240 group (1.168 [0.59%]). Major morbidity was essentially the same in both study groups; in addition, their incidence was comparable with other published morbidity rates.⁶,¹¹,¹² (Table 2). Similar to limitations in these other analyses of outcomes in office-based surgery, our study’s sample size does not allow statistical analysis.

In our cases of major morbidity, routine intubation of our patients played a significant role in these events.
and their outcomes. In 2 events (specifically, the patient who had an anaphylactic reaction to an intravenous antibiotic and the patient who had an intracerebral hemorrhage of unknown etiology), the patients already had a secure airway, which allowed the surgical team to immediately and continuously oxygenate these patients while attending to their resuscitation and treatment efforts. This directly maximized their outcomes and prevented further morbidity, if not mortality. In the third case, the aspiration respiratory event, the morbidity occurred as a postextubation obstruction event. This supports our belief that splitting up a case with low predicted morbidity into 2 separate procedures can actually increase the morbidity risk profile because of extra adverse events related to intubation and extubation.

Contrary to reports that longer procedure duration causes a higher incidence of intractable postoperative nausea, vomiting, and pain, thus necessitating higher precautionary hospitalization rates if performed in the office-based environment, we had no cases with any of these complications. Overall, we had no cases of major morbidity in which procedure duration was directly related to the complication or in which inpatient care would have prevented major morbidity events from occurring or being treated optimally.

Although major morbidity events were minimal and not attributable to procedure duration or to combining multiple procedures in the office-based surgical facility, minor morbidity events were more frequent, although still uncommon, in the more than 240 group. The complications reported are reflective of the specific risks associated with cases of longer duration in any setting.

The most common complication in our study was temporary ocular injury, specifically corneal abrasion. This was the most prevalent in patients who had previously undergone blepharoplasty procedures or who exhibited dry eyes or poor eyelid closure. Not only is there a greater need for corneal protection in these patients, but eye care is more difficult when total occlusion is not possible. In addition, the manipulation associated with the insertion and removal of protective corneal eye shields in patients undergoing blepharoplasty or laser surgery to resurface skin can also produce corneal irritation. Regardless, this points to the need for aggressive eye protection using lubricants, shields, and careful surgical manipulation. This approach is continued throughout the postoperative period, with all patients receiving aggressive eye care to minimize any potential ocular problems.

In the 3 cases of integument injury, which were reversible soft tissue breakdown, and the 2 cases of peripheral nervous system deficit, which were temporary neurapraxia, all 5 patients had complications that were directly attributable to inadequate body positioning and pressure point cushioning, the effects of which are exacerbated in procedures of longer duration. To prevent these complications from occurring, our surgical preparatory phase and intraoperative patient assessment emphasize body positioning and cushioning of all pressure points. In addition, the operative staff identifies both procedures and body types that can predispose patients to these types of injuries, and additional precautions are instituted as necessary.

We have noted a new phenomenon known as serotonin syndrome in a few cases. This manifests as a prolonged recovery from anesthesia that is related to use of specific antidepressants, the selective serotonin reuptake inhibitors class. Many of the medications used in the anesthetic technique, specifically midazolam, fentanyl, and propofol, are metabolized by the cytochrome P450 hepatic pathway. The literature states that 7% to 10% of white patients can be genetically poor metabolizers of medications metabolized by the cytochrome P450 hepatic pathway, which can predispose these patients to prolonged recovery from anesthesia, especially when the patient is taking selective serotonin reuptake inhibitors. Treatment for this condition is supportive care, and the operative staff should be prepared for these types of events.

It is our belief that multiple factors present in our study allow us to avoid major morbidity and minimize minor morbidity in combined procedures of longer duration. First, specific characteristics of facial plastic surgery permit avoidance of certain risks. Second, operating in an accredited office-based facility ensures equipment quality and maintenance as well as appropriate anesthesia practitioners (in our study, anesthesiologists). Third, having a highly trained and specialized operative team who have a detailed understanding of the needs and risks associated with these specific facial plastic surgery procedures allows all aspects of the operative environment to be tailored to preemptively address these potential problems.

Characteristics of facial plastic surgery permit the avoidance of specific risks that can exist in procedures of longer duration. Unlike many other types of surgery, facial plastic surgery is confined to the facial soft tissue, thus minimizing the occurrence of excessive blood loss, electrolyte changes, third spacing of extravascular fluid, insensible fluid loss, and the associated hemodynamic effects and cardiovascular stress. This is evidenced in our study by the fact that we reported no cardiovascular morbidity. In addition, because only the face is exposed during the procedure, appropriate body temperature can be maintained with the use of patient warming devices. For the same reason, deep vein thrombosis prophylaxis is also easily achieved with the use of thromboembolic disease support stocking and sequential leg compression devices.

Because a combined facial plastic surgery procedure is accomplished sequentially, smaller amounts of local anesthetic can be injected intermittently over a period of time, avoiding the cardiac depression related to the toxic effect of lidocaine that is a major cause of morbidity associated with liposuction.

Although we, and others, strongly believe that the safety provided by intubation (and thus using general anesthesia) in procedures of longer duration outweighs any associated risks, the concomitant use of local anesthetic effectively anesthetizes the operative field, which minimizes the type and amount of anesthetic medication required during a facial plastic surgery procedure. Use of volatile inhalation agents, such as isoflurane, desflurane, and sevoflurane, can be avoided; in addition, use of narcotics, benzodiazepine, and muscle relaxants can be minimized compared with other procedure types that cannot produce an operative field block that is as effective. The anesthetic medications used in our study consist of...
intravenous propofol, which has a high therapeutic profile, and limited and tailored amounts of nitrous oxide, midazolam, and fentanyl. Premedicating patients with anxiolytics, intraoperative use of long-acting local anesthetics, and minimal use of administered anesthetic agents are directly related to our patients avoiding postoperative nausea, vomiting, and pain as well as their characteristic rapid emergence from anesthesia.

Rapid emergence from anesthesia not only minimizes issues of prolonged recovery but, more important, also allows patients to ambulate quickly after procedures. We believe this is the reason we can avoid major morbidity events such as deep vein thrombosis and pulmonary embolism, complications that can be associated with anesthesia of longer duration. It is also our belief that the avoidance of prolonged muscle relaxation permits muscle tone to be present in the extremities during the procedure, which also contributes to the avoidance of deep vein thrombosis and subsequent pulmonary embolism.

In conclusion, our study describes 1200 facial plastic surgery procedures performed during a 10-year period, using anesthesiologists who give general anesthesia in an accredited office-based surgical facility. We sought to evaluate whether case duration in combined facial plastic surgery procedures is an indicator of morbidity and mortality. Our outcomes support the conclusion that the duration of the anesthesia itself is not an indicator of morbidity in facial plastic surgery performed in an office-based facility. Characteristics of facial plastic surgery, the use of anesthesiologists, strict patient screening, and the accreditation of the office-based facility were all factors in the minimal morbidity and lack of mortality reported in our study. Furthermore, when regulatory bodies consider creating surgical guidelines, a detailed understanding of specific risks associated with different types of surgery is needed to avoid generalization and inappropriate, non–data-driven regulation. Although this is the largest study to date that specifically evaluates consecutive cases in which anesthesia lasted more than 240 minutes, larger series of outcomes data should be compiled to guide further evaluation of morbidity risks and ensure appropriate outcomes in office-based surgery.

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