Safety of Intravenous Sedation Administered by the Operating Oral Surgeon: The First 7 Years of Office Practice

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Purpose: Outpatient intravenous sedation by properly trained personnel provides a safe, cost-effective means of anesthesia for numerous surgical procedures. The goal of this study was to provide a 7-year summary (December 1994 through November 2001) of anesthesia-related problems that occurred in the practice of a single Midwestern board-certified oral and maxillofacial surgeon.

Methods: The files of intravenous sedation cases from December 1994 through November 2001 were organized retrospectively.

Results: A total of 2,889 sedations were performed by the surgeon during the 7-year period. There were 1,743 (about 60.33%) patients in ASA Class I, 1,139 (about 39.43%) in ASA Class II, and 7 (about 0.24%) in ASA Class III. There were a total of 70 patients who had 77 adverse events. Less than 3% of the sedation patients experienced complications. There were no deaths and no patients required emergency transport to a hospital.

Conclusions: The administration of intravenous sedation by the operating surgeon for outpatient oral surgery procedures is safe and results in a low incidence of adverse events. In this series, a number of previously undiagnosed medical problems were discovered. The diagnosis and referral for management of these medical problems improved patient health.

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Outpatient intravenous sedation by properly trained personnel provides a safe, cost-effective means of anesthesia for numerous surgical procedures. There are few thorough, retrospective studies attesting to a low incidence of intravenous anesthesia complications in private practice oral surgery offices. Many studies are “surveys” in which practitioners were urged to submit answers regarding office emergencies from their memory.\(^1,2\) While these reports can be helpful in documenting life-threatening or fatal events that would be forever remembered by a physician, other less serious events are less likely to be recalled months to years after the event.

More recently, The American Association of Oral and Maxillofacial Surgeons (AAOMS) accumulated data to document in large numbers the safety of surgeon-provided anesthesia. This worthwhile project provides hard data to substantiate the continued validity of single surgeon-provided anesthesia for outpatient oral and maxillofacial surgery. The AAOMS study represents the “largest prospective patient sample ever enrolled evaluating office-based practices.” The overall complication rate was 1.5 per 100 cases for intravenous sedation. There were no long-term adverse consequences and no deaths.\(^9\)

The goal of this study is to provide a 7-year summary (December 1994 through November 2001) of anesthesia-related problems experienced by the patients of a Midwestern board-certified oral and maxillofacial surgeon in private practice. There were a wide range of procedures including extractions, impactions, dental implants, bone grafts, exposure and bonding of unerupted teeth, surgically assisted rapid palatal expansions (SARPEs), closed reduction of fractures, biopsies and treatment of pathology, etc.

The current health care environment is such that the standard of care and informed consent are paramount issues. The hope of this author is that this paper would provide documentation that single surgeon-provided anesthesia can be done safely and
cost-effectively when performed by a controlled, conscientious surgeon and staff.

**Methods**

The surgeon administering the anesthesia is a diplomate of the American Board of Oral and Maxillofacial Surgery and the National Dental Board of Anesthesiology. The practice in this study uses licensed registered nurses and anesthesia assistants who have successfully completed the AAOMS office anesthesia assistant’s course. Office emergency drills are conducted several times each year, and the surgeon obtains 25 to 30 hours of anesthesia continuing education each year. The oral surgeon undergoes Advanced Cardiovascular Life Support (ACLS) training every 2 years and follows the AAOMS Parameters of Care and AAOMS Parameters and Pathways in regard to anesthesia practices. The surgeon and all staff members successfully complete the American Red Cross class Cardiopulmonary Resuscitation for the Professional Rescuer annually. All patients must meet the established discharge criteria (Fig 1) prior to being allowed to be escorted from the office and transported home by a responsible adult. There are always 2 or more trained support personnel in the treatment room with the oral surgeon during the intravenous sedation cases.

Licensed registered nurses (A.K. and B.B.) involved in patient care retrospectively reviewed every chart and copied the anesthesia records for all intravenous sedation procedures. Each record was studied for any adverse event (emergency, changes in vital signs, drugs given to treat adverse events) as well as age, anesthesia time, American Society of Anesthesiology (ASA) status, and analysis of patient’s medical history.

The files on the number of sedation cases from December 1994 through November 2001 were then organized in groups of 50 and given an arbitrary file number and letter to assist in tracking the patient should additional information be needed from the chart. The age, surgical time, ASA status, and adverse events for each were then documented. After reviewing all patient charts from the first 7 years of practice, the nurses then reviewed and recorded the adverse events and completed a summary sheet for each event (Fig 2).

Patients received intravenous midazolam (1 to 10 mg titrated to effect). The average dose of midazolam was 5.4 mg. The narcotic used was typically fentanyl (25 to 100 µg) with an average dose of 82.9 µg. Less than 2% of patients received intravenous meperidine with an average dose of 50.0 mg. Typically low doses (5 to 20 mg) of methohexital were given prior to injections and sparingly on an as-needed basis. Patients received dexamethasone (4 to 8 mg) unless there were signs of infection, and frequently diphenhydramine (25 mg) was given intravenously.

All patients were monitored with noninvasive blood pressure, every 5 minutes, or more frequently as needed; continuous pulse oximetry; and continuous ECG monitoring. All patients were monitored visually by the surgeon, surgical assistant, and anesthesia assistant. Upon completion of surgery, the surgeon monitored the patient a few minutes prior to leaving the patient to recover under the care of the registered nurse or AAOMS anesthesia assistant.

**Results**

A total of 2,889 intravenous sedations were performed by the surgeon during the 7-year period. There were 1,743 (about 60.33%) patients in ASA Class I, 1,139 (about 39.43%) in ASA Class II, and 7 (about 0.24%) in ASA Class III. None were ASA Class IV.

There were 77 adverse events encountered as summarized in Table 1. A total of 26 patients experienced either preyncope or syncope. The next most frequent adverse event was restlessness and combative-ness, seen in 20 individuals. Ten patients experienced nausea and vomiting, while 4 developed a cardiac arrhythmia. There were 6 patients with unifocal premature ventricular contractions, and 4 of the 6 had runs of bigeminy. Three of the patients with intraoperative premature ventricular contractions, 1 of whom had bigeminy, had them preoperatively. One patient with preoperative bigeminy developed syncope postoperatively. There was 1 patient with a tachycardia (supraventricular tachycardia) in the 150 range. Four patients experienced airway or respiratory emergencies. One experienced upper airway obstruction with desaturation to a level of 88%, another desaturated easily due to obstruction that resolved with lifting of the chin, one had a severe syncopal episode resulting in apnea and cyanosis and seizure activity, and one had a partial laryngospasm that resolved after suctioning the oral pharynx. Four patients had infiltration of their intravenous lines, and 4 patients developed phlebitis. There were 2 patients (1
in the office and 1 at home) who had seizures, both of whom had syncopal episodes prior to the seizure activity. Two people experienced allergic reactions. One patient each experienced hypertension and urinary incontinence, and 1 reported a small blood clot in her urine postoperatively prior to leaving the office. She was encouraged to contact her physician for evaluation and reported no further problems. One patient was referred for immediate evaluation of hypertension to his physician, who saw him later that same day. There was one patient who "passed out" at home the evening after surgery. The patient’s mother called 911 and the patient was taken to the emergency department. After 2 to 3 hours of evaluation, monitoring, and lab work, the patient was discharged by the emergency physician with a diagnosis of syncope.

There were 6 patients who experienced multiple complications who were counted in each applicable category. One patient with postoperative hypertension also was restless and combative. Two patients became presyncopal postoperatively and then developed nausea and vomiting. One patient became apneic, cyanotic, and unresponsive after being given 2.5 mg of intravenous midozolam. This patient became hypotensive (60/30), with a sinus bradycardia (40) and an oxygen saturation that could not be detected with the finger probe for about 30 seconds. He contracted or seized in the chair for a few moments. His vital signs responded immediately to routine syncopal management (reclined with head down and feet elevated, oxygen administration, and airway support). One patient was combative with the sedation and also had repeated upper airway obstruction and significant snoring and was recommended to undergo a sleep study. One patient had multiple unifocal premature ventricular contractions and brief runs of bigeminy preoperatively and complained of being very anxious. The patient did not desaturate or experience a decrease in blood pressure and only had an occasional premature ventricular contraction after being sedated. The patient did become presyncopal after surgery.

There were 49 patients who had preoperative and postoperative hypertension who were encouraged to schedule a follow-up with their physician. Two of the patients who experienced multiple premature ventricular contractions were instructed to schedule an examination with their physician. A number of patients were rescheduled because they were found to have hypertension or a heart murmur preoperatively. They were referred to a physician for evaluation and management. Some were diagnosed with hypertension and others with valvular dysfunction requiring

**FIGURE 2.** Summary sheet for each event.

subacute bacterial endocarditis prophylaxis. Unfortunately, the number of patients referred preoperatively for medical evaluation was not tracked during this study. The preoperative screening allowed detection and referral for management of significant health problems previously unknown to patients.

The surgeon providing the intravenous sedation routinely contacts patients postoperatively the evening of surgery and schedules all intravenous sedation patients for a follow-up visit 1 week to 10 days later. There were no known hospital admissions as a result of anesthesia complications in any of the sedated patients. There were no known deaths the week after surgery in any of the sedated patients.

**Discussion**

The Southern California Society of Oral and Maxillofacial Surgeons was formed in 1968 “to address issues of quality of care in the delivery of outpatient general anesthesia.”4 Multiple 5-year surveys were conducted and a report summarizing the 20-year period from 1968 to 1987 was authored by John Lytle, MD, DDS, and Elgan Stamper, DDS, and published in the *Journal Of Oral and Maxillofacial Surgery* in 1989.3 The authors ranked the top 20 anesthetic agents in use for each of the four anesthesia surveys. In 1988, oxygen was used most frequently, followed by methohexital, local anesthesia, nitrous oxide, diazepam, dexamethasone, atropine, meperidine, midazolam, fentanyl, pentazocine, and halothane. There were a total of 1,020 anesthetic procedures per surgeon per year, which was a 28% decrease from 1972, whereas the number of local anesthetic procedures had increased by 128%.4

The anesthesia morbidity was addressed with the following question, “Did any significant untoward events such as emesis with aspiration, myocardial infarction, allergic reaction, etc. requiring hospitalization or significant concern on your part, occur in your practice during 1987?” Two members reported deaths occurring at the time of or immediately following a general anesthetic in the office during the 5-year period of 1983 to 1987. The author’s best estimate for the 20-year period was one death per 600,000 general anesthetics.4

In 1993, Chye et al11 assessed outcomes after same-day oral surgery. The authors stated that evidence suggested outcomes “associated with procedures done under local anesthesia and sedation may be better than that associated with general anesthesia when care is taken to administer effective but not excessive intraoperative sedation.” Ninety-nine percent of all patients surveyed postoperatively expressed satisfaction with their same-day surgical management.11

In 1997, Hunter and Molinaro12 published “Morbidity and Mortality With Outpatient Anesthesia: The Experience of a Residency Training Program” in JOMS. The authors reviewed records from outpatient general anesthesia cases performed at the Boston University Goldman School of Graduate Dentistry’s Department of Oral and Maxillofacial Surgery between August 13, 1990, and September 30, 1994. Morbidity with conscious sedation and deep sedation was not reviewed. General anesthesia was defined as follows: “General anesthesia is a controlled state of unconsciousness, accompanied by a partial or complete loss of protective reflexes, which may include inability to maintain an airway independently and to respond purposefully to physical stimulation or verbal demand.”

All patients were ASA Class I or II. Most received fentanyl (approximately 50 μg), diazepam (10 mg), and induction with methohexital (approximately 0.8 mg/kg) after initially receiving a test dose of approximately 20 mg methohexital to assess for hypersensitivity. Thereafter, incremental doses of methohexital (approximately 20-mg boluses) were given to maintain a sufficient level of unconsciousness. None of the patients were intubated electively or emergently. There were 1,126 general anesthesia cases with 26 incidents of morbidity (2.3%). There were no deaths.

The most common complication was laryngospasm with 9 (0.8%). Succinylcholine was not required for

### Table 1. ADVERSE EVENTS ENCOUNTERED DURING 2,889 INTRAVENOUS SEDATIONS FOR ORAL SURGERY PROCEDURES

<table>
<thead>
<tr>
<th>Event</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute angina pectoris</td>
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</tr>
<tr>
<td>Aspiration of foreign body</td>
<td>0</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>0</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>0</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>0</td>
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<tr>
<td>Death</td>
<td>0</td>
</tr>
<tr>
<td>Insulin shock</td>
<td>0</td>
</tr>
<tr>
<td>Intra-arterial injection</td>
<td>0</td>
</tr>
<tr>
<td>Malignant hyperthermia</td>
<td>0</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0</td>
</tr>
<tr>
<td>Hypertension*</td>
<td>1</td>
</tr>
<tr>
<td>Incontinence</td>
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<tr>
<td>Seizure</td>
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<tr>
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<td>Airway/respiratory</td>
<td>4</td>
</tr>
<tr>
<td>Cardiac dysrhythmia†</td>
<td>4</td>
</tr>
<tr>
<td>Intravenous infiltration</td>
<td>4</td>
</tr>
<tr>
<td>Phlebitis</td>
<td>4</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>10</td>
</tr>
<tr>
<td>Restless/combative</td>
<td>20</td>
</tr>
<tr>
<td>Presyncope/syncope</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>77</strong></td>
</tr>
</tbody>
</table>

*72 of 73 patients with hypertension had hypertension preoperatively.
†3 of 7 patients with adverse cardiac findings had them preoperatively.

any of the 9 incidents. Seven were managed with suction only, and 2 responded to positive pressure and oxygen.

The second most common complication was cardiac arrhythmia with 8 incidents (0.7%). There were 4 episodes of sinus tachycardia, 1 case of premature ventricular contractions, 2 cases of sinus arrhythmia, and 1 case of temporarily inverted P-waves. All cases resolved spontaneously, without any medical intervention. Respiratory obstruction occurred 4 times (0.4%). Three responded to placement of a nasopharyngeal airway but the fourth was due to a large hematoma of the uvula requiring evaluation by the otolaryngology department. This patient was the only one of the 1,126 in the study who required evaluation in the hospital.

There were 2 cases of vasovagal syncope, both of which occurred immediately after intravenous catheter placement (0.2%). One patient experienced angina (0.1%), which resolved with sublingual nitroglycerin. Another had hypotension (0.1%), which required intravenous atropine and ephedrine. One case of vomiting was documented (0.1%).

D’Eramo reported the results of a questionnaire sent to the 151 active members of the Massachusetts Society of Oral and Maxillofacial Surgeons in 1995. Approximately 1.5 million patients underwent office treatment during the period of 1990 through 1994. There were no office anesthetic deaths. Syncope was the most common complication, occurring in 1 of every 142 patients receiving local anesthesia. In those undergoing general anesthesia, laryngospasm occurred 10 times more frequently than bronchospasm. The author concluded that the incidence of death associated with office anesthesia, although small initially, had decreased.

In 2003, D’Eramo et al published “Adverse Events With Outpatient Anesthesia in Massachusetts.” The retrospective study reported the results of a survey of the 157 active members of the Massachusetts Society of Oral and Maxillofacial Surgeons. Approximately 1,706,100 patients were treated during a 5-year period (1995 to 1999). There were 2 treatment-related deaths for a mortality rate of 1 per 853,050. In 1999, 13 patients were sent to the hospital from the oral and maxillofacial surgeon’s office, representing an incidence of 1 per 47,692 patient visits. The authors acknowledge that the retrospective practitioner review contains inherent shortcomings in data recall. The authors noted several factors that contribute to the comparatively low mortality rate among outpatient oral surgical patients, including the fact that office procedures are usually performed on healthy ASA Class I or II patients.

The findings of this author’s retrospective study are similar to those reported by Hunter and Molinaro. Their study was also a retrospective chart review and not a survey. The author performed “deep conscious sedation,” whereas the residents in the Hunter and Molinaro study performed “general anesthesia.” The author used midazolam and fentanyl titrated to effect with occasional 5- to 20-mg doses of methohexital. The residents used diazepam (approximately 10 mg) and fentanyl (approximately 50 μg) with a test dose of 20 mg of methohexital followed by an induction dose of methohexital (approximately 0.8 mg/kg). Thereafter they gave 20-mg boluses of methohexital “as needed to maintain a sufficient level of unconsciousness.”

In comparing morbidity data, the author included nausea, presyncope, restlessness, and combativeness, which were not included in the Hunter and Molinaro publication. There was a 2.3% incidence of morbidity among the 1,126 general anesthesia cases treated by the oral and maxillofacial surgery residents at Boston University Goldman School of Graduate Dentistry between August 1990 and September 1994. In order to compare similar adverse events reported, the 20 patients who were restless and combative, the 21 with presyncope (5 had syncope with momentary loss of consciousness), and the 3 with nausea but no vomiting were taken from the author’s total. Therefore, 33 adverse events occurred in 2,889 cases of intravenous deep conscious sedation for a 1.1% incidence of morbidity. The lower rate may be due to the fact that the author did not administer as much methohexital. The level of intravenous anesthesia in this author’s study was not as deep. Perhaps the additional years of experience that the author had over the residents played a role as well. Hunter and Molinaro reported 9 episodes of laryngospasm and 4 of respiratory obstruction for a total of 13 adverse airway events in 1,126 cases for a 1.15% airway complication rate compared with 0.14% (4 of 2,889) in this study. The deeper level of intravenous anesthesia and increased methohexital administered by the residents likely explains the difference.

The 1.1% complication rate of intravenous sedation in this study is similar to the 1.5% complication rate reported by Perrott et al for intravenous sedation in the prospective study being conducted by AAOMS.

The administration of intravenous sedation given by the operating surgeon for outpatient oral surgery procedures is safe and results in a low incidence of adverse events when the operating surgeon follows an appropriate standard of care. The author discovered a number of previously undiagnosed medical problems. Considering the low number of adverse events documented in this study and others, a typical visit to an oral surgeon not only takes care of the patient’s problem that necessitated surgery but also serves as a thorough health screen capable of detecting significant medical problems (heart murmur, hypertension, cardiac arrhythmia, etc). The diagnosis and referral for management of these...
previously undiagnosed medical problems result in improved patient health.

The growing volume of literature supports the continued administration of intravenous sedation by the operating surgeon. AAOMS, state societies, and individual oral surgeons are working together to ensure the public receives safe, cost-effective anesthesia for their oral surgery procedures. This author hopes the information given here will represent the large number of private practice oral surgeons who do a nice job each day caring for the anesthesia and surgical needs of their patients.

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References