

# Adverse Events With Outpatient Anesthesia in Massachusetts

Edward M. D'Eramo, DMD,\* Steven J. Bookless, DDS,†  
and Joanne B. Howard‡

**Purpose:** This retrospective study documented the frequency of various complications associated with outpatient anesthesia.

**Patients and Methods:** A questionnaire was mailed to the 157 active members of the Massachusetts Society of Oral and Maxillofacial Surgeons (MSOMS) and all members responded. Morbidity data were obtained for the calendar year 1999. Mortality data included 1999 and the preceding 4 years. This continues our long-term survey of ambulatory oral surgical office deaths in Massachusetts since 1984. The data include anesthesia-related complications and all office deaths for the patients treated by these oral and maxillofacial surgeons.

**Results:** The most common complication in our survey continues to be syncope, which occurred in 1 in 160 patients receiving local anesthesia. The incidences of other specific anesthetic problems are given. Two treatment-related deaths occurred among approximately 1,706,100 patients treated during the 5-year period of 1995 through 1999, for a mortality rate of 1/853,050.

**Conclusions:** The results of this retrospective practitioner survey documented the specific incidence of untoward anesthetic events with outpatient anesthesia and found a mortality rate consistent with the 6 similar mortality studies since 1980. These 7 retrospective reviews found 34/28,399,193 outpatient deaths for an overall dental anesthesia mortality rate of 1/835,000.

© 2003 American Association of Oral and Maxillofacial Surgeons  
*J Oral Maxillofac Surg* 61:793-800, 2003

Avoidance of dental care frequently is based on fear of pain.<sup>1,2</sup> However, today, pain during oral and maxillofacial surgery can be predictably avoided with the use of various anesthetic agents. Over the past several years, sensationalistic reports in the media have improperly suggested that in-office outpatient anesthesia is a public safety hazard, based on a small number of cases involving dentists and dental specialists.<sup>3-6</sup>

Unfortunately, there is a paucity of national morbidity and mortality statistics related to office anesthe-

sia as practiced by qualified oral and maxillofacial surgeons. Most published reports are case reports.

Studies by Tomlin<sup>7</sup> in 1974 from the United Kingdom and Driscoll<sup>8</sup> in 1974 reported mortality rates of 1 in 274,000 and 1 in 480,000, respectively. In 1989, Lytle and Stamper<sup>9</sup> reported a 20-year (1968 to 1987) California mortality rate of one death per 673,000 anesthetics administered.

More recently, the Massachusetts experience reported in 1992<sup>10</sup> showed a 5-year (1984 to 1989) anesthetic mortality rate of approximately 1 in 1,000,000. A subsequent 5-year follow-up study from Massachusetts showed no office deaths among 1,588,000 patients treated.<sup>11</sup> A survey published by Nkansah<sup>12</sup> showed that in Ontario, Canada, oral surgeons had a mortality rate of 1.4 deaths per 1,000,000 anesthetics during 1973 to 1995.

In 1997, Hunter and Molinaro<sup>13</sup> from Boston University reported the results of their retrospective review (1990 to 1994) of outpatient morbidity and mortality in an oral surgery training program. They reported no deaths in 1,126 anesthetics.

Recent data from Lytle and Stamper,<sup>9</sup> D'Eramo,<sup>10,11</sup> and Nkansah<sup>12</sup> document an average mortality rate of 1 per 861,000 patients. Our current survey results are consistent with the other similar studies since 1980.

\*Associate Clinical Professor of Oral and Maxillofacial Surgery, Tufts School of Dental Medicine; Associate Clinical Professor of Dental Care Management, Boston University, Goldman School of Graduate Dentistry, Boston, MA.

†Clinical Instructor, Oral and Maxillofacial Surgery, Tufts School of Dental Medicine, Boston, MA.

‡Executive Secretary, Massachusetts Society of Oral and Maxillofacial Surgeons, Norwell, MA.

Address correspondence and reprint requests to Dr D'Eramo: 69 Malden St, Revere, MA 02151

© 2003 American Association of Oral and Maxillofacial Surgeons  
0278-2391/03/6107-0009\$30.00/0  
doi:10.1016/S078-2391(03)00238-6

**Table 1. MEAN WEEKLY NUMBER OF PATIENTS TREATED**

Anesthesia Used	1984	1989	1994	1999
General anesthesia	12	10.8	10	11
Parenteral sedation and local	16	14.8	9	8
Conscious sedation (N <sub>2</sub> O and local)	4	5.8	3	3
Local anesthesia alone	30	28.8	22	24
No anesthesia: consult/post	—	—	36	38
Total patients per week	62	62.2	80	84

## Methods

Methods used were described in our previous publication in 1992.<sup>10</sup> For simplification and to encourage compliance, only 3 terms were defined. These definitions were taken from the Board of Registration in Dentistry in Massachusetts. *General anesthesia* is considered 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 command.

*Parenteral sedation* is considered a depressed level of consciousness produced by intravenous, intramuscular, subcutaneous, or rectal medication. This may be accompanied by a partial loss of protective reflexes.

*Nitrous oxide-oxygen sedation* is considered sedation accomplished solely by the use of nitrous oxide-oxygen.

By returning the questionnaire in an unmarked envelope within a numbered envelope, respondents were identified. Nonrespondents to the initial mailing received 2 additional monthly mailings. The few remaining nonrespondents were then contacted by the Massachusetts Society of Oral and Maxillofacial Surgeons (MSOMS) executive secretary. Each individual's questionnaire was anonymous to the principal investigators.<sup>14</sup> A 100% response was obtained from the 157 active members of the MSOMS. Morbidity data were obtained for the calendar year 1999. Mortality data for 1999 and the preceding 4 years were obtained, thereby continuing our long-term survey of oral surgical office deaths in Massachusetts since 1984. To decrease the probability of omitting an office fatality, letters were sent to each county medical examiner in the state. The responses corroborated our practitioner-reported mortality figures.

## Results

The 157 active members (100%) of the MSOMS responded to our anesthesia questionnaire. In 1999, they worked a mean of 47 weeks and saw a mean of

84 patients per week. Forty-five percent (278,757) of the patient visits to their offices were for patients not receiving anesthesia or surgery, that is, consultation and post-operative visits. The mean number of patients treated weekly with various methods of anesthesia is shown in Table 1. These comparative percentages have not changed significantly over the past 15 years. The mean time frame for acquiring NPO status before intravenous sedation or general anesthesia was 6.7 hours for adult patients and 6.3 hours for pediatric patients. The most commonly used intravenous anesthetic agents were methohexital (78%) and midazolam (71%). Other anesthetic agents used at least once per month are listed in Table 2. Among our members, in 1999, lidocaine with epinephrine continues to be the most commonly used local anesthetic consistent, with our previous data dating back to 1984. The frequency of other local anesthetic agents used in office anesthesia at least once per month is given in Table 3. Among more than 600,000 patient visits in 1999, there were no elective intubations and only 2 emergency intubations. Methods of monitoring reported in the survey used more than once per week with outpatient anesthesia are as follows:

Blood pressure monitoring	146 Members	93%
Oximeter	145 Members	92%
Cardioscope	121 Members	77%
Precordial stethoscope	66 Members	42%

During the 15 years of our documentation, pulse oximetry has increased in use 71% to 92% and precordial stethoscope monitoring had decreased in use from 98% to 42%.

**Table 2. ANESTHETIC AND ADJUNCTIVE AGENTS USED IN 1984, 1989, 1994, AND 1999**

Agent	1984 (%)	1989 (%)	1994 (%)	1999 (%)
Nitrous oxide	80	97	88	87
Methohexital	83	90	79	78
Midazolam	—	48	63	71
Diazepam	84	79	69	62
Fentanyl	20	38	48	61
Atropine	14	20	22	26
Ketamine	5	7	10	26
Glycopyrrolate	1	7	11	19
Halothane	22	25	20	17
Meperidine	16	13	13	11
Propofol	—	—	3	8
Nalbupine	9	10	7	6
Thiopental	0.6	1	2	2
Pentobarbital	4	3	1	1
Scopolamine	0.6	0.7	1	1
Sevoflurane				0

NOTE. Percentage of respondents indicating anesthetic agent was used at least once per month in 1984, 1989, 1994, and 1999. Agents are listed in the order of 1999 frequency.

**Table 3. LOCAL ANESTHETICS USED IN 1984, 1989, 1994, AND 1999**

Agent	1984 (%)	1989 (%)	1994 (%)	1999 (%)
Lidocaine with epinephrine	81	89	83	85
Mepivacaine	51	69	71	72
Bupivacaine with epinephrine	28	44	55	55
Lidocaine without epinephrine	33	35	25	28
Prilocaine	16	18	18	20
Mepivacaine with neocobefrine	16	20	18	17
Etidocaine with epinephrine	—	7	7	13

NOTE. Percentage of respondents indicating local anesthetic agent used in office anesthesia at least once per month in 1984, 1989, 1994, and 1999. Agents are listed in the order of 1999 frequency.

The most frequent untoward event in Massachusetts oral surgical offices continues to be syncope occurring with local anesthesia. Of 178,647 patients receiving local anesthesia alone, 1,119 of them fainted (1/160 patients). These data indicate the continuing need to recognize the frequent occurrence of syncope in the oral surgical office. The incidence cited of syncope occurring with general anesthesia (1/430) relates to patients fainting before or after the surgical procedure.

The frequency of untoward events using the different anesthetic methods used in the office setting is given in Table 4 and 5.

Laryngospasm continues in our series to be approximately 9 times more common than bronchospasm in patients under office general anesthesia. These data become clinically useful when the cause of airway obstruction is uncertain in a patient receiving general anesthesia. Laryngospasm continues in our series to be the most common complication occurring in patients receiving general anesthesia (1/345). This is consistent with our previous findings and the findings of Hunter and Molinaro.<sup>13</sup>

Dysrhythmia requiring drug therapy occurred in 43/80,323 patients receiving general anesthesia (1/1,868). Only 1 incident of “neck injury or nerve injury associated with positional changes during anesthesia” was reported. This occurred in a patient receiving general anesthesia. “Aspiration of tooth or foreign body” was found to be a rare occurrence among the 5 categories of patients. Four categories showed no aspiration. Only 2 patients aspirated and both received parenteral sedation and local anesthesia.

Adverse events associated with anesthesia are categorized by anesthetic methods used and are cited in Tables 4 and 5. During 1999, 13 patients were sent to a hospital from the oral and maxillofacial surgeon’s office representing an incidence of 1/47,692 patient visits. These cases are described here.

**Table 4. ADVERSE EVENTS CATEGORIZED BY ANESTHETIC METHOD USED**

Event	General Anesthesia (n = 80,323)	Parenteral Sedation and Local Anesthesia (n = 57,575)	Nitrous Oxide Sedation and Local Anesthesia (n = 24,675)	Local Anesthesia (n = 178,647)	No Anesthesia (n = 278,757)
Syncope	187	220	95	1,119	222
Laryngospasm	233	69	0	0	0
Bronchospasm	25	21	0	0	0
Allergic reaction requiring drug therapy	11	21	0	0	10
Convulsion	2	6	0	17	3
hypotension requiring drug therapy	15	15	0	5	0
Hypertension requiring drug therapy	16	3	0	4	1
Dysrhythmia requiring drug therapy	43	20	0	2	0
Neck or nerve injury associated with positional change during anesthesia	1	0	0	0	0
Phlebitis	89	76	0	0	0
Intra-arterial injection of medication	1	2	0	2	0
Intra-arterial penetration of needle	5	3	0	5	0
Vomiting with aspiration	5	4	3	0	0
Aspiration of tooth or foreign body	0	2	0	0	0
Insulin shock	0	0	0	0	1
Diabetic ketoacidosis	1	0	0	0	0
Congestive heart failure	0	0	0	1	0
Cerebrovascular accident	0	0	0	0	1
Myocardial infarction	1	0	0	0	2
Acute angina pectoris	1	1	1	6	1
Malignant hyperthermia	0	0	0	0	0

**Table 5. PROBABILITY OF ADVERSE EVENTS CATEGORIZED BY ANESTHETIC METHOD USED**

Event	General Anesthesia (n = 80,323)	Parenteral Sedation and Local Anesthesia (n = 57,575)	Nitrous Oxide Sedation and Local Anesthesia (n = 24,675)	Local Anesthesia (n = 178,647)	No Anesthesia (n = 278,757)
Syncope	1/430	1/262	1/260	1/160	1/1,256
Laryngospasm	1/345	1/834	0/24,675	0/178,647	0/278,757
Bronchospasm	1/3,213	1/2,742	0/24,675	0/178,647	0/278,757
Allergic reaction requiring drug therapy	1/7,302	1/2,742	0/24,675	0/178,647	1/27,876
Convulsion	1/40,161	1/9,596	0/24,675	1/10,509	1/92,919
Hypotension requiring drug therapy	1/5,355	1/3,838	0/24,675	1/35,729	0/278,757
Hypertension requiring drug therapy	1/5,020	1/19,192	0/24,675	1/44,662	1/278,757
Dysrhythmia requiring drug therapy	1/1,868	1/2,879	0/24,675	1/89,324	0/278,757
Neck or nerve injury associated with positional change during anesthesia	1/80,323	0/57,575	0/24,675	0/178,647	0/278,757
Phlebitis	1/903	1/758	0/24,675	0/178,647	0/278,757
Intra-arterial injection of medication	1/80,323	1/28,787	0/24,675	1/89,324	0/278,757
Intra-arterial penetration of needle	1/16,065	1/19,192	0/24,675	1/35,729	0/278,757
Vomiting with aspiration	1/16,065	1/14,394	1/8,225	0/178,647	0/278,757
Aspiration of tooth or foreign body	0/80,323	1/28,787	0/24,675	0/178,647	0/278,757
Insulin shock	0/80,323	0/57,575	0/24,675	0/178,647	1/278,757
Diabetic ketoacidosis	1/80,323	0/57,575	0/24,675	0/178,647	0/278,757
Congestive heart failure	0/80,323	0/57,575	0/24,675	1/178,647	1/278,757
Cerebrovascular accident	0/80,323	0/57,575	0/24,675	0/178,647	1/278,757
Myocardial infarction	1/80,323	0/57,575	0/24,675	0/178,647	1/139,379
Acute angina pectoris	1/80,323	1/57,575	1/24,675	1/29,775	1/278,757
Malignant hyperthermia	0/80,323	0/57,575	0/24,675	0/178,647	0/278,757

## Report of Cases

The following 13 cases are presented as reported by various treating surgeons.

### CASE 1

A 43-year-old white man was to undergo full mouth extraction. Electrocardiographic monitoring revealed 8 to 10 unifocal premature ventricular contractions (PVCs) preoperatively. Patient was otherwise hemodynamically stable. He was sedated with midazolam/fentanyl. His dysrhythmia completely disappeared for seven minutes. On injections of mepivacaine 3%, PVCs returned to 15 to 20 per minute. This was unresponsive to lidocaine and converted to trigeminy/bigeminy. The surgical procedure was aborted. The patient was transported from the office to the emergency department and underwent a full cardiac work-up, which was negative. The patient did admit to intermittent chest pain for the week preceding his oral surgery. His brother had undergone emergency coronary artery bypass graft surgery  $\times$  4 at age 45.

### CASE 2

A patient experienced convulsion during parenteral sedation and local anesthesia. Vital signs were stable throughout the procedure. The patient was transported to the hospital and underwent overnight observation. The patient continued to be stable, alert, and oriented. The patient was discharged the next morning. After the event, a parent informed our office that the patient had a similar episode at home without taking any medications.

### CASE 3

A 79-year-old man with a history of ventricular tachycardia developed hypotension, which did not respond to fluid challenge and Trendelenberg position. He was taken to the emergency department from the office and discharged from the hospital the same day. This was thought to be a probable vasovagal reaction. There was no evidence of myocardial infarction.

## CASES 4 AND 5

Emergency department treatment with later discharge from the emergency department to home was required for a convulsing patient (case 4) and an allergic patient (case 5). Both, in my opinion, were related to methohexital.

## CASE 6

A diabetic patient who had a severe submandibular infection developed hypoglycemia. This required admission to the hospital for blood sugar control and later surgery.

## CASE 7

An office patient developed atrial fibrillation with a rapid ventricular response. The patient was transported to the hospital and monitored overnight. Verapamil was given in the emergency department with no further problems.

## CASE 8

A patient with cocaine abuse experienced a convulsion. Emergency medical technicians were called, and the patient was hospitalized. No further problem developed.

## CASE 9

A 74-year-old man came into the oral surgery office for a consultation and had an acute cardiac arrest in the waiting room. He was not yet a patient of record. The patient was intubated and defibrillated. Full advanced cardiac life support protocol was followed. Patient was taken to the hospital and died 2 weeks later.

## CASE 10

A patient with a history of asthma developed wheezing in the oral surgery office. The patient desaturated to 89% and then was maintained at 95% oxygen saturation with a full-face mask and treatment with bronchodilators intravenously. Patient was transported to the emergency department by paramedics from the oral surgery office. Aerosolized treatments were administered in the emergency department, and the patient was discharged from the emergency department a few hours later.

## CASE 11

A patient was taken from oral surgery office to hospital for observation, where fluids were administered. (No further notation is given.)

## CASE 12

A patient with mitral regurgitation and chronic obstructive pulmonary disease developed sudden acute

pulmonary edema at the end of a minor biopsy with local anesthesia. This was most likely due to anxiety and congestive heart failure secondary to mitral insufficiency with tachycardia. The patient was transferred to a hospital accompanied by me. Furosemide was given intravenously. At the hospital, the patient was intubated and placed on a ventilator.

## CASE 13

A patient was sent to the emergency department to evaluate for phlebitis. Vital signs were stable. The patient was discharged to home without event. The phlebitis resolved.

The question was asked, "Have any patients you have treated experienced cardiac arrest during or immediately following (within 24 hours) treatment in your office in the past 5 years (January 1, 1995, to December 31, 1999)?" Two cases were reported.

## CASE 1

A 25-year-old white man presented for the removal of impacted teeth. The electrocardiographic monitor, pulse oximeter, and automatic blood pressure cuff were placed in preparation for anesthesia. All readings were normal. A nasal mask was placed for preoxygenation. Oxygen saturation was 98% to 100%. An intravenous line was started with a 22-gauge intracath. Ten milligrams of diazepam was administered over 2 to 3 minutes. Vital signs continued to be normal. Fifty micrograms of fentanyl was injected slowly. Twenty milligrams of methohexital were given. All was normal and the patient was conversant as lidocaine 2% with epinephrine 1:100,000 was injected on the buccal and palatal aspects of the maxillary right third molar. The patient responded to this injection. Forty milligrams of Brevital was then administered intravenously. The patient became ashen and blood pressure dropped. He was placed in Trendelenberg and given positive pressure oxygen through the nasal mask. This was changed to the full-face mask and an emergency was declared. An associate entered to assist. The chest was very rigid and difficult to move. Anectine 40 mg was given. An oropharyngeal airway was inserted. The chest remained rigid. The patency of the airway was questioned. The oropharyngeal airway was removed, and positive pressure ventilation again was given through a full-face mask. The patient was removed to an ambulance, where a cuffed oral tube was placed and he was transported to the emergency department. There the patient went into ventricular fibrillation and was defibrillated. Defibrillation was successful, and he was placed on a ventilator and moved to the coronary intensive care unit. Over the next 24 to 36 hours, the patient had several more episodes of ventricular fibrillation and

was transported to a nearby teaching hospital, where he ultimately died.

#### CASE 2

A patient was treated for acute oral pain with intravenous sedation, local anesthesia, and extraction of teeth. The patient experienced chest pain 24 hours later and died. The patient was in a terminal stage of prostate cancer. The true cause of death was not sought as far as we know.

Assuming the same number of patients treated in 1999 (317,313) were treated during the preceding 4 years, the Massachusetts mortality rate for the 5-year period of 1995 to 1999 is 2 deaths per 1,706,100 patients treated. The mortality rate for the 15 years of our 3 surveys is 4 deaths/5,377,270 patients treated, an incidence of 1/1,344,317.

The question was asked "Have any patients you have treated died within a week of office treatment in the past 5 years (January 1, 1995 to December 31, 1999)?" Four positive responses were received, as follows.

#### CASE 1

The patient was admitted to the hospital with acute onset of congestive heart failure about 36 hours post-operatively after one uneventful extraction with mepivacaine. The patient died when the family decided to make the patient DNR. The patient's cardiologist thought extraction/local anesthesia had no part in the outcome.

#### CASE 2

A man approximately 60 years old presented with several periodontally involved teeth and a negative medical history other than dental apprehension. He underwent general anesthesia using diazepam and methohexital plus local anesthesia. The procedure lasted 25 minutes. The intraoperative course and the office component of the postoperative course were uneventful. A telephone call to the patient at 10:00 PM on the evening of surgery revealed that he was pleased and amazed that he had no pain. A later call from the medical examiner revealed that the patient died in his sleep from an abdominal aneurysm.

#### CASE 3

A 74-year-old man had a fatal myocardial infarction 7 days after a biopsy of carcinoma of his maxilla.

#### CASE 4

A 38-year-old white man underwent incision and drainage of his right buccal space infection in the office with local anesthesia. Thirty-six milligrams of local anesthesia was infiltrated into the right buccal vestibule. The procedure lasted less than 10 minutes. The patient left the office completely stable and with baseline vital signs.

He had given no significant past medical history. However, he was found dead in his apartment 3 days after treatment. Post mortem examination revealed coronary artery disease. Afterward, his family indicated a significant family history of coronary artery disease.

## Discussion

Practitioner surveys lack objectivity. The reported complications and deaths were not objectively observed or objectively reported.<sup>15</sup> Our method of a retrospective practitioner review contains inherent shortcomings in data recall.<sup>8</sup> Nkansah<sup>12</sup> addressed this issue by obtaining mortality data from the coroner's office, professional liability carrier, and practitioners for the study of office mortality in the province of Ontario, Canada. We attempted to approach objectivity by soliciting mortality data from practitioners and from county coroners. There were no new deaths found from coroners to add to those reported by clinicians. As a comparison, gastrointestinal endoscopy is frequently performed with parenteral sedation analogous to oral surgical procedures. One large-scale study<sup>16</sup> found an estimated incidence of serious cardiovascular complications of 54 per 10,000 patients and a mortality rate of 3 deaths per 10,000 patients.

Among the factors that contribute to the comparatively low mortality rate among out-patient oral surgical patients are the following:

**Table 6. 1966 THROUGH 1974 COMPARATIVE MORTALITY RATES FOR DENTAL OFFICE ANESTHESIA**

Author	Year Published	Type of Anesthesia	Deaths/Patients	Approximate Mortality Rate
Driscoll <sup>18</sup>	1966	General	5/1,575,000	1/315,000
Tomlin <sup>7</sup>	1974	General, sedation, local	29/7,956,000	1/300,000
Driscoll <sup>8</sup>	1974	General, sedation, local	11/5,285,570	1/480,500
Lytle <sup>19</sup>	1974	General	3/1,295,000	1/432,000
Total			48/16,111,570	1/335,000

**Table 7. 1980 THROUGH 2002 COMPARATIVE MORTALITY RATES FOR DENTAL OFFICE ANESTHESIA**

Author	Year Published	Type of Anesthesia	Deaths/Patients	Approximate Mortality Rate
Lytle and Yoon <sup>21</sup>	1980	General	0/1,285,000	0/1,285,000
Lytle and Stamper <sup>9</sup>	1989	General	7/4,700,000	1/672,000
D'Eramo <sup>10</sup>	1992	General, sedation, local	2/2,082,805	1/1,000,000
Nkansah <sup>12</sup>	1997	General, sedation	4/2,830,000	1/707,500
D'Eramo <sup>11</sup>	1999	General, sedation, local	0/1,588,365	0/1,588,000
Deegan <sup>20</sup>	2001	General, sedation	19/14,206,923	1/747,000
D'Eramo et al	2003	General, sedation, local	2/1,706,100	1/853,050
Total			34/28,399,193	1/835,000

- Procedures are usually performed on healthy American Society of Anesthesiologists (ASA) Class I or II patients.
- Although performed in the airway, respiratory complications due to the surgical procedure are minimal.<sup>9-11</sup>
- Oral surgery is not usually performed on a highly vital organ. Surgical procedures involving the heart, lung, and brain entail anesthetic risk due to the basic pathology that brought the patient to the operating room.
- On developing an anesthetic problem, oral surgical procedures usually can be aborted within seconds without significant adverse effect and full attention directed to the management of the anesthetic problem. There is usually little time required to close the oral wound as compared, for example, to closing the peritoneum.
- A procedure to remove multiple teeth can be discontinued after the first or second tooth is removed, should anesthesia not be proceeding smoothly. Additional treatment can be scheduled at another time with a different type of anesthetic, (ie, local anesthesia) without significant surgical morbidity or distress to the patient.

Table 6 compares mortality data of the well-documented studies of dental office deaths in the English-speaking literature published between 1966 and 1974. Since that time, there have been only 7 well-documented studies of oral surgical office deaths in North America. Importantly, these 7 studies cited in Table 7 have shown a clustering of the data for office death rates at approximately 1/835,000 patients. This clustering of data lends support to the validity of this low mortality rate.

A review<sup>17</sup> of 1,541 cases of hospital-based anesthetic morbidity by ASA found that "adverse respiratory events" were the single largest category of patient anesthetic injury. The case reviewers judged that better monitoring would have prevented 72% of these adverse outcomes.

This conclusion may also explain the lower dental mortality figures in studies published since 1980 (Table 7). As cited in the specific death case reports by Tomlin,<sup>7</sup> monitoring of dental outpatients in England during 1963 to 1968 was abysmally absent in his series of dental office anesthetic deaths. This total lack of monitoring often in patients under intravenous anesthesia may explain the higher dental death rate in English studies before 1980 (Table 6).

As can be appreciated by comparing Table 6 with Table 7, in recent years (1980 to 2003), the mortality rate for outpatient anesthesia has decreased by more than half.

## References

1. Berggren U, Meynert G: Dental fear and avoidance: Causes, symptoms and consequences. *J Am Dent Assoc* 104:247, 1984
2. Dionne RA, Gordon SM, McCullagh LM, et al: Assessing the need for anesthesia and sedation in the general population. *J Am Dent Assoc* 129:167, 1998
3. Mabrey V: Going to the dentist: transcript, CBS News 60 Minutes II, Dec 13, 1999. Available at: <http://www.cbsnews.com/stories/1999/01/18/60limain28972.shtml>. Accessed March 18, 2002
4. Rodrigues J: Grand jury may hear case of toddler's dentistry death. *The Houston Chronicle*, Section A, p 37, October 13, 2001
5. Associated Press: Family sues hospital dentist after bizarre death. August 30, 2000. Available at: <http://www.web.lexis-nexis.com/universe/printdoc>. Accessed March 21, 2002
6. Byron K: Dental office death investigated. *The Hartford Courant*, September 22, 2000, p A3
7. Tomlin PJ: Deaths in outpatient dental anesthetic practice. *Anesthesia* 29:551, 1974
8. Driscoll EJ: ASOS Anesthesia Survey. *J Oral Surg* 32:733, 1974
9. Lytle JJ, Stamper EP: 1988 Anesthesia survey of the Southern California Society of Oral and Maxillofacial Surgeons. *J Oral Maxillofac Surg* 47:834, 1989
10. D'Eramo E: Morbidity and mortality with outpatient anesthesia: The Massachusetts experience. *J Oral Maxillofac Surg* 50:700, 1992
11. D'Eramo EM: Mortality and morbidity with outpatient anesthesia. *J Oral Maxillofac Surg* 57:531, 1999
12. Nkansah PJ: Mortality incidence in outpatient anesthesia for dentistry in Ontario. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 83:646, 1997
13. Hunter MJ, Molinaro AM: Morbidity and mortality with outpatient anesthesia: The experience of residency training program. *J Oral Maxillofac Surg* 55:684, 1997

14. Abrahamson JH: Survey Methods in Community Medicine (ed 4) New York, NY, Churchill Livingstone, 1990, p 131
15. Allnut MF: Human factors in accidents. *Br J Anesth* 59:586, 1987
16. Arrowsmith JB, Gerstman BB, Fleishcher DE, et al: Results from the American Society for Gastrointestinal Endoscopy/US Food and Drug Administration Collaborative study on complication rates and drug use during gastrointestinal endoscopy. *Gastrointest Endosc* 37:421, 1991
17. Caplan RA, Posner KL, Ward RJ, et al: Adverse respiratory events in anesthesia: A closed claim analysis. *Anesthesiology* 72:828, 1990
18. Driscoll EJ: Proceedings of the Conference on Anesthesia for the Ambulatory Patient. Presented at the ASOS 48th Annual Meeting, September 19, 1966
19. Lytle JJ: Anesthesia morbidity and mortality survey of the Southern California Society of Oral Surgeons. *J Oral Surg* 32:739, 1974
20. Deegan AE: Anesthesia morbidity and mortality, 1988-1999: Claims statistics from AAOMS National Insurance Co. *Anesth Prog* 48:89, 2001
21. Lytle JJ, Yoon C: 1978 Anesthesia morbidity and mortality survey: Southern California Society of Oral and Maxillofacial Surgeons. *J Oral Surg* 38:814, 1980

*J Oral Maxillofac Surg*  
61:800, 2003



## Discussion

### Adverse Events With Outpatient Anesthesia in Massachusetts

*Paul G. Sims, DDS*

Private Practice, Butte, Montana; e-mail: pgsims@int-tch.com

I commend the authors for their third consecutive study in which a 100% response rate was achieved. This retrospective survey of the members of the Massachusetts Society of Oral and Maxillofacial Surgeons assessed morbidity and mortality data for 5 years.

The mortality rate for the 5-year period from 1995 through 1999, for patients undergoing conscious sedation or general anesthesia in Massachusetts was 1:853,050. This mortality rate compared favorably with 7 retrospective studies published since 1980, in which the mortality rate for dental anesthesia collectively was 1:835,000. There were 4 studies published from 1966 through 1979 that, when added together, gave a mortality rate of 1:335,000. The authors of this study conclude the improvement in mortality rates could be related to an increase in the use of monitoring modalities. In the authors' 1992 article, the pulse oximeter in 1988 was used by 71% of the respondents. The electrocardioscope (ECS) was used by 85% of the respondents. The percentage use of the noninvasive blood pressure (NIBP) monitor was not included. In the 1999 study the use of the pulse oximeter had increased to a 93% rate. The ECS use was 76%, and blood pressure was monitored by 93% of the respondents. Compared with the 1999 results, the rates reported by the authors in this new study show the rates of use of these monitors to be unchanged.

The American Association of Oral and Maxillofacial Surgeons (AAOMS) in both the *Office Anesthesia Evaluation Manual*<sup>1</sup> and *Parameters and Pathways*<sup>2</sup> recommend continual use of pulse oximetry and regular interval blood pressure monitoring for patients undergoing any form of sedation or general anesthesia. When deep sedation/general anesthesia is used, the ECS should also be included. A majority of states have patterned their office anesthesia

regulations after the AAOMS *Office Anesthesia Evaluation Manual*, and so the use of these 3 monitoring modalities is outlined in their rules and regulations.

As previously mentioned, one reason the mortality rates for dental anesthesia have improved since 1980 is the development and use of the pulse oximeter as well and the use of the ECS and NIBP monitor. Because the use of these monitoring devices is recommended as a way to safely provide anesthesia, I wonder why only 92% to 93% of the oral and maxillofacial surgeons in this study use the pulse oximeter and NIBP monitor and not a higher percentage.

The authors describe many of the untoward events that have occurred and the relative percentage of the problems. In 1999, 13 patients were transferred from the oral and maxillofacial office or clinic to the emergency department or hospital for various problems. No major common threads were identified within this group of patients.

The authors point out several shortcomings with retrospective studies and surveys. Among the problems mentioned were defects in the data recall. The AAOMS is currently collecting data for a prospective outcomes assessment of anesthesia in the oral and maxillofacial offices. When this study is released, it will be interesting to compare these data with other published studies.

I urge the authors and the Massachusetts Society of Oral and Maxillofacial Surgeons to continue their periodic review of office-based anesthesia and report their findings.

### References

1. AAOMS: Office Anesthesia Evaluation Manual (ed 6). Rosemont, IL, American Association of Oral and Maxillofacial Surgeons, 2000, p 25
2. AAOMS: Parameters and Pathways Version 3.0, Rosemont, IL, American Association of Oral and Maxillofacial Surgeons, pp ANE 10-15