Reducing the need for intubation in plastic surgery

LYLE E. GATES, CRNA, BSN
EDWARD N. HAMACHER, MD, JD
DAN SIMONSON, CRNA, BSN
Spokane, Washington

Many plastic surgery procedures that have traditionally been performed under general endotracheal anesthesia may safely be undertaken using a ketamine-based intravenous sedation technique. General endotracheal anesthesia has many drawbacks, including lack of patient acceptance.

Ketamine-based intravenous sedation technique includes the following steps:

1. The patient is placed in a dissociated state using sedative and narcotic agents accompanied by a subanesthetic dose (0.5 mg/kg) of ketamine.
2. A dilute local anesthetic solution (0.25% lidocaine with 1:2,000,000 epinephrine) is infiltrated into the involved tissues to provide anesthesia and hemostasis.
3. The patient is maintained in a tranquil state throughout the procedure by periodic titration of additional doses of sedative and narcotic agents.

Advantages of the technique include reducing the need for intubation and its associated hazards, dramatically decreased blood loss due to use of dilute epinephrine solution, reduced recovery time, ability of patients to respond to commands during surgery, avoidance of positioning injuries and increased rapport between patient, surgeon and anesthetist. Disadvantages include respiratory depression and potential for hypoxia. Dissociative intravenous sedation combined with dilute local anesthetic provides a useful addition to the anesthetist's armamentarium.

Key words: Endotracheal intubation, intravenous sedation, ketamine, lidocaine, local anesthesia.

There is a multiplicity of indications for intubation in plastic surgery: rhinoplasty with submucous resection, reduction mammoplasty, prone procedures, prolonged cases, abdominoplasty, etc. Yet, every one of these types of surgeries has been done safely and comfortably without general anesthesia and its incumbent endotracheal tube.¹

Patient comfort

Most patients fear pain or the possibility of pain during a surgical procedure. Indeed, many frequently ask what they will experience while under a general anesthetic. On the other hand, many also fear “being under” and would prefer a conscious, but sedate, state. A technique which deals with both of these issues has been developed.² ³

Preoperative preparation

As with other anesthetics, patients are required to have nothing by mouth 8 hours prior to the procedure. The authors have not found gastric acid or volume prophylaxis to be necessary in more than 4,000 cases.
Table I
Subcutaneous lidocaine dosages for various surgical procedures using 0.25% with 1:2,000,000 epinephrine

<table>
<thead>
<tr>
<th>Operation</th>
<th>Average mL</th>
<th>High</th>
<th>Low</th>
<th>Average mg</th>
<th>High</th>
<th>Low</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominoplasty</td>
<td>1,900</td>
<td>2,400</td>
<td>900</td>
<td>4,750</td>
<td>6,000</td>
<td>2,250</td>
<td>13</td>
</tr>
<tr>
<td>Augmentation</td>
<td>440</td>
<td>644</td>
<td>140</td>
<td>1,100</td>
<td>1,610</td>
<td>350</td>
<td>64</td>
</tr>
<tr>
<td>Reduction mammoplasty</td>
<td>1,618</td>
<td>1,730</td>
<td>500</td>
<td>4,050</td>
<td>4,325</td>
<td>1,250</td>
<td>21</td>
</tr>
<tr>
<td>Lower face and neck</td>
<td>344</td>
<td>430</td>
<td>125</td>
<td>860</td>
<td>1,075</td>
<td>312</td>
<td>16</td>
</tr>
<tr>
<td>Mastopexy</td>
<td>416</td>
<td>645</td>
<td>295</td>
<td>1,040</td>
<td>1,612</td>
<td>737</td>
<td>3</td>
</tr>
<tr>
<td>Complete face lift</td>
<td>410</td>
<td>975</td>
<td>200</td>
<td>1,025</td>
<td>2,457</td>
<td>500</td>
<td>43</td>
</tr>
<tr>
<td>Suction lipectomy of hips, thighs, abdomen</td>
<td>1,145</td>
<td>2,150</td>
<td>450</td>
<td>2,862</td>
<td>5,862</td>
<td>1,128</td>
<td>6</td>
</tr>
</tbody>
</table>

Anesthetizing the surgical area

The aspect of pain is addressed by infiltrating the surgical area with large volumes of dilute anesthetic. Fifty milliliters of plain 0.5% lidocaine is mixed with 15 mL of 0.5% lidocaine with 1:200,000 epinephrine and 60 mL of 0.9% saline. The final concentration becomes lidocaine 0.25% with epinephrine 1:2,000,000. This anesthetic is infiltrated with a bullet-tipped needle which comes in variable lengths. The blunt tip of the needle minimizes blood vessel laceration, while the injection ports are positioned slightly behind the tip to avoid intravascular injection.

A potential problem might be seen with lidocaine or epinephrine toxicity using large amounts of the above mixture. To anesthetize areas for suction lipectomies, for instance, the authors typically use 1,500-2,000 mL without adverse effect. (See Table I.) The majority of studies done in the authors' office, however, have yielded blood levels of approximately half the 5 pg/mL toxic threshold described by Bigger and Hoffman (including one case which required 2,800 mL). (See Table II and Figure I.)

Intravenous sedation with ketamine

In order for the patients to tolerate the infiltration, the authors place them in a dissociated state...
Figure 1
This is a graphic representation of Table II.
The authors feel this data is suggestive of the average blood levels of lidocaine following subcutaneous injection of a dilute lidocaine solution for liposuction; however, further study under more rigorous clinical conditions is warranted and advised.

![Graph showing serum lidocaine levels](image)

with a combination of medications (Table III). All patients receive an oral dosage of prochlorperazine 10 mg and, for those cases lasting longer than 11/2 hours, secobarbital 100 mg. An IV is begun (usually an antecubital to lessen the incidence of phlebitis) and diazepam 10-20 mg along with oxymorphone 1-2 mg is titrated until the patient is sedated. The authors look for slurring of words as the end point.

At this stage, ketamine is titrated at a rate of 2-3 mg/min up to 50-60 mg or until the patients exhibit signs of dissociation, e.g., nystagmus, staring, one-word answers to questions and temporary short-term memory loss. They will then accept the local with minimal or no discomfort for a period of 45-60 minutes. At the end of this time frame, the dissociated state (amnesia and analgesia) will have dissipated; if further local injections become necessary, they may need a “top up” dose of 10-15 mg of ketamine.

Occasionally, despite a seemingly adequate amount of preketamine sedation, the patients will not be completely relaxed. This is a situation that calls for an adjunct medication to potentiate the others. Small dose (i.e., 2.5 mg) of either diphenhydramine or prochlorperazine usually produces the desired effect. This dose may be repeated in 5 to 10 minutes; however, it cannot be overemphasized that these adjuncts, even at these low doses, can give tremendous potentiation, particularly in terms of respiratory depression.

### Table III
Summary of conscious sedation technique

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Administer prochlorperazine 10 mg orally. If procedure to exceed 1 hour, administer secobarbital 100 mg orally.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>Start IV with 500 mL of 5% dextrose in Ringer’s solution.</td>
</tr>
<tr>
<td>Step 3</td>
<td>Titrate 0.2 mg atropine sulfate when indicated for bradycardia, facial procedure, nasal procedure and excessive secretions.</td>
</tr>
<tr>
<td>Step 4</td>
<td>Titrate diazepam at rate of 2 mg/min up to 10 mg or 20 mg depending on patient response. End point is a completely relaxed patient. Allow at least 2 minutes between each dose of diazepam, oxymorphone and/or ketamine. Note: if patient is excited rather than tranquil, stop diazepam and give midazolam or droperidol. Titrate midazolam 1 mg/2 min.</td>
</tr>
<tr>
<td>Step 5</td>
<td>Simultaneously: Titrate oxymorphone at rate of 0.1 mg/min not to exceed 1-2 mg. End point is a respiration rate of 12-14/min. Titrate to 50 mg ketamine at a rate of 2 mg/min. End point is a dissociated state. Note: When midazolam, diazepam and oxymorphone are given separately by titration, there is no hypopnea or apnea problem.</td>
</tr>
<tr>
<td>Step 6</td>
<td>Reversal drugs for hypopnea include physostigmine for diazepam and midazolam and naloxone for oxymorphone. Note: For reversal procedure, reverse diazepam or midazolam first.</td>
</tr>
<tr>
<td>Step 7</td>
<td>For maintenance doses, titrate diazepam in increments of 1-2 mg and/or oxymorphone 0.1 mg every 20-30 minutes. To potentiate the above, use promethazine (e.g., 2.5 mg at a time) up to 10 mg.</td>
</tr>
</tbody>
</table>
Additionally, it needs to be stated that some patients are not good candidates for this type of anesthesia. Besides those who refuse it, those who have rigidly controlled personalities are difficult to manage as they begin to become sedated and dissociated (they almost always require potentiator medications). This technique is not intended to replace general anesthesia, but it can be an option in the array of techniques currently available. For a summary of the technique, see Table III.

Advantages of dissociated anesthesia

Since the patients are ventilating themselves, intubation is not required. Considering that most serious anesthesia mishaps arise out of airway management problems such as esophageal or endobronchial intubation and circuit disconnects, patient safety in this regard can be enhanced.

That is not to say one does not have to worry about ventilation or become complacent about it. Indeed, we find it necessary to be even more vigilant in this regard, especially during the induction phase with ketamine. Monitoring by pulse oximeter is mandatory for safe practice. Also, since nearly all patients will hyperventilate, supplemental oxygen at 4-6 L/min is given, and they are encouraged verbally to deep breathe every 2-3 minutes (less often as the ketamine peak effect dissipates). In the authors’ practice, patients will typically maintain a saturation of greater than 96% using these safeguards. Additional monitoring can be provided by use of a recent innovation: end-tidal CO₂ monitoring through specially manufactured nasal O₂ cannula.

Second, blood loss is dramatically reduced because of the vasoconstrictive effect of the epinephrine, in spite of its very low concentration. Typical losses at the authors’ clinic are as follows: reduction mammoplasty—150-200 mL, full face lift (brow, lateral and lower)—300-500 mL, breast augmentation—50 mL, abdominoplasty—100-150 mL, leg and buttock suction lipectomy—50 mL. Obviously, less loss means less need for transfusion and its inherent problems. It also means less potential cardiovascular instability due to intravascular loss.

A third advantage is a reduced recovery time. Looking at the combination of medications and the dosages given would lead one to suspect that patients would spend a great deal of time in recovery. When applied in the manner outlined, though, patients usually meet standard discharge criteria in 30-60 minutes. We insist that a responsible adult be present for 24 hours at home as the patients will be sedate for awhile. In fact, most want to sleep for a few hours afterward. But the point is that they are able to leave quite early, which is a great reduction in the cost of hospitalization.

The fourth consideration is patient cooperation with commands. It has already been pointed out that they need to be reminded to deep breathe every few minutes. During rhinoplasty, patients can be instructed to open their mouths for secretion/blood suctioning as they feel the need. Before ketamine titration, this command or any other potential act they will be called upon to perform should be presented; this will “program” them to be active participants in their care. Patients can also assist in the placement of dressings by responding to commands such as arching their backs, lifting their buttocks off the table, sitting or standing up. Anyone suffering from back strain secondary to moving patients can appreciate this advantage fully.

Fifth, improper positioning which could lead to nerve damage becomes unlikely. Patients place themselves before a procedure, such as suction lipectomy in the prone position, to their best advantage. And, as the ketamine effect dissipates, patients will be aware of uncomfortable stretch or pressure and adjust themselves accordingly. Or they may verbalize their discomfort. At any rate, the problem can be rectified early.

Finally, there seems to be better development of rapport with patients. The surgeon and anesthetist have to give more personal attention to them, which greatly enhances their relationship with the health care provider.

Disadvantages and complications of ketamine-based intravenous sedation technique

Respiratory depression is seen with nearly every case, particularly during the peak ketamine effect. It can be profound if the rate of drug titration is too rapid, which is the reason we recommend slow administration (typical induction time is 20-30 minutes). Also, as previously stated, we use supplemental oxygen frequently and encourage deep breathing.

Infrequently, though, the ventilation will be too low, at which point one can use low doses of pharmacologic antagonists. The authors have found that physostigmine in 0.1 mg increments works best for several reasons. First of all, most of the depression seems to be a result of the diazepam and/or ketamine effect. After reversing these medications, more can later be titrated for increased sedation as needed. Second, if naloxone is given, not only the depression but also the analgesia is reversed. However, if needed, naloxone may be titrated in doses of 0.04 mg.

Buffington and associates described an inci-
dence of nausea and vomiting in approximately 10% of patients. Other complications can include excitement, ventricular arrhythmia and respiratory depression. In more than 4,000 cases, the authors have found it necessary to admit 26 patients to the hospital postoperatively for various reasons such as prolonged sedation or lack of an appropriate caregiver.

As with all anesthetics, the ready availability of positive-pressure oxygen, suction and intubation equipment, as well as personnel trained in their use, is essential.

Summary

Plastic surgeons have been using variations of this technique for office-based surgery for many years. The authors have found a lack of familiarity with its many advantages among CRNAs and anesthesiologists. Once versed in the technique, practitioners may apply it to similar situations in hospital settings such as painful dressing changes, chest tube insertion, breast biopsy, escharotomy, mammography, magnetic resonance imaging and other situations where general anesthesia is best avoided and yet painful stimuli prevent patient cooperation.

REFERENCES


AUTHORS

Lyle E. Gates, CRNA, BSN, received his BSN from California State University, Sacramento. In 1983, he graduated from the Nurse Anesthesia Program at the University of California at Los Angeles. Currently, he is a clinical and didactic instructor at Sacred Heart Medical Center and is Director of Anesthesia Services at the Hamacher Cosmetic Surgery Clinic, Spokane, Washington.

Edward N. Hamacher MD, JD, received his medical education at Georgetown University in 1943. In 1956, he received his JD degree from Gonzaga University, Spokane, Washington. Currently, he has a private practice in plastic and reconstructive surgery in Spokane, Washington.

Dan Simonson, CRNA, BSN, received his BSN from Arizona State University in 1976 and his nurse anesthesia education at Arizona State University in 1981. Presently, he is manager and anesthetist for the Spokane Eye Surgery Center, Spokane, Washington.

April 1991/ Vol. 59/No. 2