Dissociative Anesthesia in an Office-Based Plastic Surgery Practice

Charles A. Vinnik, M.D.¹

ABSTRACT

In 1974, the author began to use ketamine in association with diazepam for cosmetic and reconstructive procedures. Since then, through courses in the United States and abroad, well over a thousand plastic surgeons have been taught the technique. Ketamine, by itself, ablates sensory input of pain at the thalamic level but has been associated with hallucinations, bad dreams, and other untoward effects. These can be prevented by the use of benzodiazepines, which “bracket” the use of ketamine. If the patient is sedated and awakens under the influence of these agents, there is no adverse ketamine effect. Specific techniques and adjunct agents are described.

KEYWORDS: Ketamine, Valium[®], midazolam, Robinul[®], Versed[®], fentanyl, dissociative anesthesia

By 1974, the author realized that performing common cosmetic surgical procedures in hospital operating rooms under general anesthesia was becoming prohibitively expensive for patients on a self-pay basis. This was true even on a day-surgery basis. At that time, even newly developed outpatient operating rooms in hospitals were excessively costly. Anesthesiologists in the hospital setting often charged patients almost as much as the surgeon's fee. Furthermore, at that time, board-certified anesthesiologists rarely ventured out of hospital settings and thus were unavailable for anesthesia in plastic surgeons' office surgical settings. Thus, the author explored techniques for outpatient anesthesia that would not depress respiration, did not need inhalation anesthetics, and, most importantly, met the most important criteria of patient safety.

For many years, ketamine was very popular in children's burn centers, having been used since the early 1960s for debridement of burns in children. Even with children, the often-described post-ketamine hallucinations were seen occasionally. A literature review revealed

that diazepam with ketamine was reported to be in regular use for open-heart surgery¹ by means of a micro-drip technique in a major hospital setting. Surely, if it was satisfactory for that purpose, it should be of value for breast augmentation.

Gradual implementation of diazepam as well as very low doses of ketamine (approximately one-half to one-fourth of the recommended dose listed in the *Physician's Desk Reference*) proved to be sufficient to achieve both amnesia and protection against painful operative stimuli with no emergence of reactions. Ketamine has a clinical duration of effect of an average of 10 minutes and diazepam has its clinical duration of effect of ~45 minutes. Thus, it was realized very early that the greatest drawback, emergent reactions typified by hallucinations and hyperexcitability, to the use of ketamine could be avoided.

Regular use of these agents coupled with local anesthesia began in 1974, with the author having personally performed in excess of 10,000 cases without incident since then.

¹Las Vegas, Nevada.

Address for correspondence and reprint requests: Charles A. Vinnik, M.D., 8028 Marbella Circle, Las Vegas, NV 89128. E-mail: vinnikmd@cox.net.

Office-Based Plastic Surgery; Guest Editor, Robert A. Ersek,

M.D., F.A.C.S.

Semin Plast Surg 2007;21:109–114. Copyright © 2007 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662.

DOI 10.1055/s-2007-979211. ISSN 1535-2188.

The major drawback to the increased use of these agents today is one of "turf" with anesthesiologists fiercely resisting the use of this *dissociative anesthesia technique* by nonanesthesiologists. Many younger, more recently trained anesthesiologists have begun dispensing with their gas machines, respirators, and endotracheal tubes and have begun using ketamine in their office surgical practices. This is now popular with anesthesiologists, as office surgery has grown to proportions whereby most cosmetic procedures are done outside of hospitals. There is now a Society for Ambulatory Anesthesia.

Today, the American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) recognizes *dissociative anesthesia* wherein no support of the cardiac and respiratory systems is necessary as a recognized technique of managing patients undergoing outpatient surgery. This organization is currently the largest accrediting body for outpatient surgery centers and has been recognized by California and other states in lieu of state licensing.

HOW KETAMINE GOT ITS BAD REPUTATION

Ketamine was initially clinically evaluated in the United Kingdom. There, regulations forbid combining the agent being tested with any other medication. Thus, according to Domino,² there is just reason for the bad reputation surrounding ketamine. Additionally, the drug is related to phencyclidine (PCP), a dangerous hallucinogen, and the drug has been equated with that agent. Ketamine is abused today in the drug culture for its hallucinogenic effect and is known as "Special K." During the Vietnam conflict, the medics were using ketamine for battlefield casualties. Unfortunately, owing to its short duration of effect, often the drug would wear off while patients were in helicopters for transport causing unmitigated pain and hallucinations. Needless to say, the U.S. Department of Defense soon put out a regulation forbidding its use. This did nothing to help its reputation.

MECHANISM OF ACTION

Fundamentally, ketamine acts on the pain receptor sites in the thalamus, blocking transmission of pain sensation to higher centers.² In addition, it is a potent amnesic agent as are the benzodiazepines. The hallucinogenic potential of the drug is not blocked at this lower level of brain function, thus necessitating this vital concept regarding its use: *Patients must never be allowed to lose or regain consciousness while under the effects of ketamine.* It is for this reason that the use of other agents is imperative. Patients must awaken under the influence of a medication that can accomplish this reliably. Many

anesthesiologists have become enamored of propofol. While this is an excellent agent for keeping patients asleep, it does not have the necessary reliable amnesic qualities of the benzodiazepines unless used in very skillful hands. There have been several cases reported to the author of hallucinations after propofol use with ketamine where no benzodiazepines have been used. It is suspected that the propofol wore off prior to the ketamine.

Ketamine can depress respirations when used with diazepam or midazolam but more often, it acts as a respiratory stimulant. Ketamine does not produce postoperative emesis, however sometimes the benzodiazepines and particularly any opiates used with it may. Ondansetron is now used when any patient announces preoperatively that they always "vomit after surgery" or when opiates are used. This has largely eliminated postoperative emesis.

Pulse pressure and heart rate are commonly stimulated, although rarely are excessive elevations of either noted. It is imperative not to give atropine, glycopyrrolate, or scopolamine preoperatively as their vagolytic action enhances the sympathomimetic action of ketamine causing serious increases in blood pressure and pulse rate. Typically, small elevations of pulse rate and blood pressure are noted with the initial dosage. These are not frequently seen with subsequent doses. Pain on injection is not seen with ketamine; it is actually a very good nerve-blocking agent (B. Friedberg, personal communication).

Excessive salivation occasionally occurs when ketamine is used. Glycopyrrolate or atropine readily corrects this. These vagolytic agents can be used at any time that hypersalivation or bradycardia occurs without causing the problems noted above when used as preoperative medication.

The gag reflex may be enhanced when ketamine is used. Therefore, endotracheal intubation is generally contraindicated. When using it in operations requiring pharyngeal suctioning such as rhinoplasty, suitable topical anesthesia of the oropharynx is necessary.

Ketamine is probably the safest anesthetic agent known with an extremely wide range of therapeutic dosages. Unlike any inhalation anesthetic with the exception of the now banned cyclopropane, it does not produce peripheral vasodilation; thus blood loss is dramatically reduced. This is especially true when combined with a vasopressor in the local anesthetic.

MEDICAL ADVANTAGES

In the thousands of cases of using benzodiazepines with ketamine, the author has never had the need for endotracheal intubation. There is little depression of respiration and no cardiac depression. Although these agents are typically short acting, by dose repetition, they can be used for cases of varying length. They can be used with

impunity for cases lasting over many hours, even in the elderly. Compared with general inhalation, narcotic, propofol, or barbiturate anesthetics, they have the widest margin of patient safety. Typically, when anesthesiologists have used ketamine, they have used anywhere between two and four times the author's recommended dosage. There is reduced nausea and vomiting, and when midazolam, ketamine, and particularly propofol are used without opiates, the postoperative emesis rate is reportedly reduced to virtually nothing.³ Propofol has antiemetic properties. Amnesia of the procedure adds a tremendous psychological benefit and goes a long way toward making patients happy with their surgeon's care. It is rare that more than an hour's recovery time is needed, and during that period, there is little danger of the patient showing depression of vital signs and functions. To reiterate the obvious, if a patient is truly tranquil during surgery, the procedure can be done more rapidly, and with the wide margin of patient safety for long operations, more individual procedures can be done at the same time.

ECONOMIC ADVANTAGES

The only commodity a surgeon has for sale is time. Without the need to commute to a hospital or free-standing surgicenters, with the inevitable delays involved with waiting for a previous case to be completed, more efficient use of time can be achieved. All aesthetic and virtually, if not all, reconstructive procedures can be accomplished in the office surgicenter.

Many plastic surgeons have opened their operating facilities to other surgical specialists. Most outpatient surgical procedures can also be performed by them using this modality; although if these other surgeons have no experience with these dissociative agents, the participation of an anesthesiologist is advised.

The office surgicenter can be operated profitably and yet cost the patient less than most hospital-based or freestanding ambulatory surgery centers.

As stated before, there is no need for an anesthesiologist or nurse anesthetist as long as propofol is not added to the dissociative regimen, adding to patient savings without compromising safety. Thus, the surgeon has a competitive advantage over his peers who do not self-administer dissociative anesthesia in their own facilities.

If one operates an office surgicenter without the need for purchasing and maintaining anesthesia machines, additional monitors to monitor patient function under inhalation agents, and modifying or building the OR to handle discharge of these gases, set-up and operating costs are fractional. Purchasing the anesthetic gases is an expensive proposition compared with the low relative costs of the intravenous dissociative agents.

MEDICATIONS TO BE USED

The technique to be described uses as its cornerstone the benzodiazepines, diazepam and or midazolam, and ketamine. Other medications may be incorporated also, but these must *always be used*. The exception is for propofol, which can substitute for the benzodiazepines providing that nurse anesthetists or anesthesiologists carefully administer it. Bolus injections of propofol, unlike the benzodiazepines, are to be avoided.

Medications used for longer cases in the surgeon's judgment consist typically of the opiate of choice such as morphine, meperidine, hydromorphone, or the synthetic opiates. These may be coupled with phenothiazine such as promethazine to prolong their effect and achieve greater sedation. These agents cause lower requirements of the benzodiazepines and to a lesser extent ketamine. They do, however, cause respiratory depression often necessitating the use of oxygen, sometimes by positive-pressure ventilation.

Fentanyl is often used, particularly when there is considerable muscle retraction such as in subpectoral breast augmentations. It is also useful in those patients who have idiosyncratic reactions to benzodiazepines or in whom a tolerance has developed. This is more common with diazepam than with midazolam. Some have substituted fentanyl for the drugs cited above, but because of the inevitable postoperative nausea and vomiting as well as respiratory depression, the author reserves its use only when the other agents are not effective.

Glycopyrrolate given at or near the conclusion of the operation is often helpful in prevention of postoperative nausea and vomiting secondary to its aid in ameliorating postural hypotension. It can be used whenever ketamine-induced excessive salivation occurs. The usual dose is 0.4 mg. Atropine or glycopyrrolate if given preoperatively can cause excessive tachycardia, and blood and pulse pressure increases. Physiologically, the vagolytic effect markedly enhances the sympathomimetic effect of the ketamine.

Propofol has been previously discussed. It should be remembered that the dose between apnea and a patient being wide awake is just a very few drops. Sometimes patients who are under propofol with no or inadequate benzodiazepine coverage remember everything, even when apneic. The use of the bispectral index monitor (Aspect Medical Systems, Newton, MA)⁴ eliminates the guesswork in determining whether the patient is asleep or just deeply sedated and aware of everything. Although the cost of propofol is much greater than diazepam, midazolam, and ketamine, it is much less than the anesthetic gases and the paraphernalia needed for their administration.

WHY USE KETAMINE

In the author's opinion, there is no place in the performance of precise, meticulous plastic surgery for excessive

movement of the patient. There should be *tranquility* in the operating room. Loud moaning, shouting, or thrashing about or for that matter any unanticipated movement is not appropriate in any surgicenter let alone one within an office setting devoted to plastic surgery. To achieve comparable tranquility with the use of opiates or barbiturates, excessive depression of respiration often occurs. This is also true of the benzodiazepines when used in larger dosages.

USE OF AN ANESTHESIOLOGIST OR NURSE ANESTHETIST

Although an anesthesiologist or nurse anesthetist may be used with the dissociative anesthesia technique, they are not necessary, and unless they are willing to follow the protocol to be outlined, they may be a serious hindrance. It is essential that these professionals be thoroughly versed in the technique, as excessive variation can actually be hazardous. Many plastic surgeons are far more comfortable with another professional handling the patient's airway and medication administration. In these instances, no argument against the use of these individuals should be considered. Many anesthesiologists like to use propofol. They should develop that use with a room air technique and no intubation. The disadvantage of using propofol without a benzodiazepine may be that when the patient awakens virtually instantly after the surgical procedure, he or she may feel "too normal" and thus become too active thus causing bleeding complications. Many surgeons appreciate this instant alertness, others do not.

ECONOMIC ADVANTAGES

The only commodity plastic surgeons have for sale is their time. The surgeon using this technique in his or her own surgical facility avoids commuting to various hospitals and surgicenters, which wastes that valuable commodity. The surgeon is also able to save the patient the cost of a nurse anesthetist or anesthesiologist. As stated above, should the plastic surgeon seek to employ this technique in hospitals or freestanding surgicenters, the chances are that it will not be allowed as anesthesiologists claim it to be a general anesthetic over which they have ultimate control and authority.

Dissociative anesthesia has been defined by the AAAASF as a separate technique, not general anesthesia. This organization defines general anesthesia in terms of the necessity of support of cardiac and/or respiratory functions (i.e., gas and intubation). AAAASF is the largest accrediting agency in the United States with respect to outpatient surgical facilities. The Joint Commission of American Health Organizations (JCAHO) has essentially adopted the same criteria for use of these agents. In summary, the use of ketamine with benzo-

diazepines is more effective, less expensive (for patients and physician cost), and safer than general anesthesia or other neuroleptic or analgesic agents.

TECHNIQUE

The recommended technique has been found to be effective in many thousands of cases beginning in 1974. It has not fundamentally varied. Others who have been taught the technique sometimes advocate lower doses of the benzodiazepines and ketamine. These same people like to be able to communicate with their patients (although the author cannot imagine what intelligent conversation can be held with such a deeply sedated patient). Lower ketamine doses in instances to be described but lower than recommended doses can be unreliable and actually can result in an agitated patient. With experience, the surgeon adopting this technique will make individual dosage variations. An intravenous line preferably by indwelling plastic needle such as an angiocath is placed in the largest possible vein to minimize the chance of phlebitis and, of greater importance, to enable the rapid bolus administration of our medications. Our preferred site is the external jugular vein in the neck. This in an emergency is as close to the heart as one can get without going into the chest; medications work virtually instantaneously compared with the arm. The author rarely uses intravenous (IV) fluids but rather uses a heparin lock. Fluids are administered only for medical indications, not routine hydration. This keeps the bladder from unnecessarily filling and eliminates the patient's need to void on the table or immediately post-operatively. Healthy patients do not need the customary IV fluids. All patients are continuously monitored with an electrocardiogram (EKG) monitor, pulse oximeter, and automatic blood pressure monitor. Oxygen by positive pressure as well as oral and/or nasopharyngeal airways with oxygen administration catheters and cannulas must be available for use if needed. Failure to have this equipment for a patient falls below the standard of care for any office surgical procedure under any type of sedation. All vital signs must be frequently recorded.

For lengthy cases (in excess of 2 hours) or one that may have substantial traction pain (possibly as in subpectoral breast augmentation) or where segmental perforating nerves are cut (as in abdominoplasty), preoperative sedation administered intravenously is given. For patient safety, no preoperative medications are administered by mouth or intramuscularly. After this has taken effect, the next step is undertaken. *For cases under 2 hours without the above conditions, no narcotics are administered.*

1. Five milligrams diazepam or a small dose is next administered. This is a "test" dose to determine the

patient's tolerance to the medication. The typical patient shows mild sedation, although in some sensitive individuals, this may actually put them to sleep.

2. Next, the patient is prepped and draped. Having the patient completely sedated and then applying cold prep solutions can be very disconcerting to patients and cause the need for more sedation than is otherwise required.
3. Additional diazepam (or midazolam) is administered by rapid bolus injection. Generally, 15 mg diazepam suffices. The dosage is dependent on patient response. This should put the patient "asleep." Failure to elicit a blink response is one measure of this. Another very practical method is to have the patient count backward out loud from 200. Typically, they rarely get past 190. If they go much beyond that, more diazepam up to ~30 mg total is given.
4. Thereafter, if the desired response is still not achieved, midazolam is used or if a tolerance for diazepam exists it is not used thereafter.
5. Midazolam 2.5 to 5 mg is typical, but sometimes even more is needed. Should even that not be adequate, then fentanyl is used by *slow* bolus injection. Rapid injection of this drug virtually always produces apnea.
6. At this point, the patient is ready to have ketamine administered.
7. A 75 mg initial dose is routinely administered regardless of weight. Calculation of doses in terms of mg/kg is virtually useless, particularly in the low doses we use. This dose has been arrived at by trial and error over thousands of cases. More is usually not needed and less often does not adequately ablate the pain response. *The variation in brain weight between adults is negligible, and that is where these agents work.* The ketamine is administered more slowly intravenously, and even so, fairly marked respiratory depression may be briefly encountered. The author used this technique before pulse oximeters became available and never worried about the apnea, as it was short-lived. Since that device has become routinely used, oxygen by positive pressure or by mask flush is commonly employed. This initial apnea should always be anticipated and prepared for.
8. Rapid infiltration of lidocaine with epinephrine is then possible without the patient feeling any pain. If repeated painful stimulation occurs that is not handled by the local anesthesia, then within ~10 minutes, the patient may need more ketamine. It has been found that subsequent doses of 50 mg usually suffice. When repeated ketamine injections are required every 10 minutes or so, often as little as

25 mg doses may be sufficient. It is often difficult for the novice to determine if the patient needs more benzodiazepine or ketamine. If the patient articulates, diazepam or midazolam is needed. If there is a groan or stimulus response, ketamine is required. If one is doing facial surgery and the patient's head is difficult to turn, more benzodiazepine is needed. It must be kept in mind that diazepam persists ~45 minutes (on average) whereas midazolam lasts 10 minutes in terms of effective response. Therefore, if only midazolam is used without diazepam, the ketamine and midazolam have to be given virtually simultaneously. Even though the half-life of midazolam is 50% that of diazepam, the total dosage typically is much higher and the aftereffects are about the same. Midazolam, even though now generic, is more expensive than generic diazepam particularly considering the frequency of dose administration.

9. Toward the conclusion of the case, 0.4 mg glycopyrrolate is administered, again by rapid bolus to inhibit or prevent postural hypotension and inhibit the production of gastric juices. It is administered earlier if there is any hypersalivation. The dry mouth produced encourages the patient to rehydrate orally.
10. If any opiates have been used, there is a high incidence of postoperative emesis. This also appears to be the case when patients state that they "always throw up after surgery." Ondansetron 4 mg by rapid IV bolus prevents this or should it occur during recovery will usually "rescue" the patient from this problem.

Finally, it must be remembered: *The patient must always go to sleep and wake up under the influence of the benzodiazepine . . . never ketamine!! Only by adherence to this rule can there be assurance that hallucinations, bad dreams, or "bad trips" will be avoided.*

SOME IMPORTANT CONSIDERATIONS TO KEEP IN MIND

Although this technique is very safe, it should not be used in patients who do not fit the ASA class 1 or 2 categories. Patients over 60 years of age or those with any adverse medical history findings should be worked up first. The stress EKG is probably the single best prognosticator of how a patient will fare under this dissociative anesthesia technique. The blood pressure and pulse are elevated to maximal levels, and abnormalities such as myocardial ischemia should show up. Naturally, a thorough medical history and physical examination is indicated for these patients in whom statistically some degree of cardiovascular disease might be anticipated. It

may not be wise to depend on clearance by the "family doctor" as the necessary diagnostic studies may not have been done. Evaluation by an independent physician in whom the surgeon has confidence and who is cognizant of the medications to be used is probably the safest measure.

- Postoperative emesis is greatly diminished by the use of H₂ antagonists given the evening prior to and the morning of surgery.
- All nonsteroidal anti-inflammatory agents should be avoided as they prolong bleeding time significantly and are known to cause upper gastrointestinal irritation and ulceration. They also can cause acute renal failure when used to control postoperative discomfort. This is a controversial opinion, but I base it on personal experience in the use of these agents. When they are used, the concomitant use of the H₂ antagonists is recommended.
- In this era when drug abuse is rampant, this technique has been found to be both safe and effective for patients who abuse these "recreational drugs." The amounts of medication needed are often prohibitive, yet these patients seem to recover almost instantaneously at the procedure's conclusion with no adverse aftereffects. "They pop up like toast."
- Malignant hyperthermia is a dread complication of general anesthetics. The American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF) and other accrediting organizations require that dantrolene (Dantrium[®] [Proctor & Gamble Pharmaceuticals, Cincinnati, OH]), a very expensive antidote, be available on-site. *Malignant hyperthermia does not occur with IV dissociative anesthesia.*

CONCLUSION

Anesthesiologists⁵ out of ignorance have vilified the intravenous dissociative anesthesia technique. For reasons of "turf" restrictions, plastic surgeons are generally prohibited from administering it themselves within hospitals or freestanding surgicenters. Nonetheless, it has gained tremendous popularity over the years by plastic surgeons working in their own surgicenters and is an officially endorsed technique by the AAAASF. The margin of safety is very wide; typically much more so than any other medication combination. The cost to physician and therefore the patient is minimal as compared with general anesthesia, and the patient experience is far more pleasant⁵ than reported by patients who have had both general and dissociative anesthesia. All aesthetic and virtually all reconstructive plastic surgical procedures can be done by this method.⁶

REFERENCES

1. Hatano S, Dove MS, Keane DM, Boggs RE, El-Naggar MA. Diazepam-ketamine anesthesia for open heart surgery: "micro-mini" drip administration techniques. *Anaesthetist* 1976;25: 457
2. Domino EF. Status of ketamine in anesthesiology. Ann Arbor, MI: N.P.P. Books; 1990:583
3. Friedberg BL. Propofol-ketamine technique. *Aesthetic Plast Surg* 1993;17:297-300
4. Friedberg BL. The effect of a dissociative dose of ketamine on the bispectral index (BIS) during propofol hypnosis. *J Clin Anesth* 1999;11:4-7
5. Gallozzi E, Van Poznak A, Artusio JF, Vinnik CA. Ask the Annals: is there a place for the use of ketamine in plastic and reconstructive surgery? *Ann Plast Surg* 1980;4:85
6. Vinnik CA. An intravenous dissociation technique for outpatient plastic surgery: tranquility in the office surgical facility. *Plast Reconst Surg* 1981;67:799-805