Technical Communication

A Total Intravenous Anesthetic Technique for Outpatient Facial Laser Resurfacing

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The increasing use of minimally invasive surgical techniques has facilitated recovery after a wide variety of ambulatory surgical procedures. It has also created new challenges for anesthesia practitioners. For example, the highly specialized surgical equipment required to perform these procedures has created unique anesthetic requirements. The carbon dioxide (CO_2) laser used for facial "resurfacing" (so-called laser abrasion) procedures requires intense analgesia with minimal distortion of the skin by anesthesia equipment and avoidance of supplemental oxygen (O_2). Because conventional anesthetic and sedative-analgesic techniques require the use of supplemental O_2, a technique was developed that involves using a combination of IV anesthetic and nonopioid analgesics to achieve adequate intraoperative patient comfort while minimizing the need for opioid compounds and for interventions to manage airway-related problems (e.g., desaturation, airway obstruction). Total IV anesthesia (TIVA) is well suited for outpatient plastic surgery procedures (1).

In an effort to avoid opioid-induced respiratory depression, ketamine has become an increasingly popular alternative because of its unique sedative/amnestic/analgesic profile and absence of clinically significant ventilatory depression (e.g., respiratory rate <8 breaths/min and/or hemoglobin oxygen saturation value <85%). Unfortunately, the use of ketamine is also associated with cardiovascular stimulation and psychomimetic emergence reactions (2). Concomitant administration of the benzodiazepines diazepam and midazolam has been reported to be effective in minimizing these side effects during plastic surgery (3). More recently, propofol has also been reported to prevent ketamine-induced cardiovascular stimulation and psychomimetic emergence reactions when administered as part of a TIVA technique (4). In outpatients premedicated with midazolam 1–4 mg IV, Friedberg (5) described a technique involving the use of a propofol infusion, 100 $\mu g \cdot kg^{-1} \cdot min^{-1}$ (range 20–226 $\mu g \cdot kg^{-1} \cdot min^{-1}$) in combination with intermittent bolus doses of ketamine (50 mg IV). However, this technique provided inadequate analgesia for the facial laser procedures despite extensive supplementation with local anesthetic solutions (data not reported). Therefore, it was necessary to supplement the basic midazolam/ketamine/propofol anesthetic technique with both opioid and nonopioid analgesic drugs.

We describe a TIVA technique that has facilitated the performance of facial resurfacing procedures in the ambulatory setting without producing excessive cardiorespiratory depression (>80% of baseline values) or prolonged recovery times.

Anesthetic Technique

On arrival in the day surgery unit 60–90 min before surgery, all patients were premedicated with oral clonidine 0.2 mg (<65 kg), 0.3 mg (65–80 kg), or 0.4 mg (>80 kg), and diazepam 5–10 mg PO. Before transporting the patient to the operating room, midazolam 2–5 mg, dexamethasone 5–10 mg, ketorolac 30–60 mg, and glycopyrrolate 0.3–0.5 mg were administered IV. All patients received 500 mL of fluid IV before the induction of anesthesia. Maintenance fluid therapy was administered at a rate of approximately 750 mL/h. Anesthesia was induced with propofol 1 mg/kg IV administered over 60 s, followed by a maintenance infusion of 100 $\mu g \cdot kg^{-1} \cdot min^{-1}$. Before initiating the local anesthetic injections, ketamine 0.5 $mg \cdot kg^{-1}$ was injected, followed by an infusion at an initial rate of 35 $\mu g \cdot kg^{-1} \cdot min^{-1}$. The subsequent infusion rates of propofol and ketamine were varied to maintain an adequate depth of hypnosis (i.e., eyes

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Table 1. Demographic Characteristics, Premedication and Intraoperative Anesthetic Drugs, and Recovery Profiles of Twenty Women Undergoing Outpatient Facial Laser Resurfacing Procedures

Age (yr)	52 ± 11
Weight (kg)	59 ± 8
Preanesthetic medications (mg)	
Diazepam	7.5 ± 3.3
Clonidine	0.3 ± 0.5
Midazolam	3.2 ± 0.9
Dexamethasone	8.0 ± 1.4
Ketorolac	41 ± 14
Glycopyrrolate	0.36 ± 0.25
Surgery time (min)	43 ± 27
Anesthesia time (min)	69 ± 19
Intraoperative anesthetic drugs	
Propofol (mg; $\mu g \cdot kg^{-1} \cdot min^{-1}$)	346 ± 183; 78 ± 36
Ketamine (mg; $\mu g \cdot kg^{-1} \cdot min^{-1}$)	108 ± 73; 28 ± 15
Fentanyl (μg)	91 ± 73
Propranolol (mg)	1.0 ± 0.5
Labetalol (mg)	12 ± 5
Ambulation time (min)	48 ± 33
Home readiness (min)	99 ± 46
Discharge time (min)	137 ± 75
Postoperative emetic symptoms	
Nausea	7 (32)
Vomiting	2 (9)
Antiemetics	7 (32)
Postoperative analgesic requirements	
Oral	10 (45)
Intravenous	6 (27)

Values are mean ± SD or *n* (%).

closed, spontaneous respiration at a rate of 12–20 breaths/min) and analgesia (i.e., absence of facial grimacing, vocalization, purposeful movements), respectively. Heart rate values >100 bpm and mean arterial pressure values >100 mm Hg were treated with propranolol 0.25–0.5 mg IV and labetalol 5–10 mg IV, respectively. If the cardiostimulatory activity persisted, supplemental bolus doses of propranolol (0.25 mg IV) and labetalol (5 mg IV) were administered.

A local anesthetic solution (lidocaine 0.5%) containing epinephrine 1:400,000 was infiltrated to block the supraorbital, supratrochlear, and mental nerves. In addition, a field block was performed around the entire perimeter of the face. This approach provided adequate analgesia except when the surgeon was lasering the upper eyelids, the brow, and the nasolabial folds. Therefore, small bolus doses of fentanyl (12.5–25 μg IV) were administered 2–3 min before initiating the lasering process in these highly sensitive areas. The doses of the anesthetic drugs administered to the first 20 patients undergoing the laser abrasion procedure are summarized in Table 1.

None of the patients managed with this anesthetic regimen required supplemental oxygen to maintain a room air oxygen saturation value >85%. However, transient upper airway obstruction occurred in four patients and was treated with intermittent jaw thrust maneuvers by the surgical assistant (to avoid having to contaminate the surgical field). When the obstructive signs were not relieved by lifting the mandible, the patient's head was transiently rotated to the side.

Approximately 20–30 min before the end of the operation, the ketamine infusion was discontinued, and the propofol infusion was terminated on completion of the lasering procedure. All patients were awake and oriented at the time of discharge from the operating room. Despite the local anesthesia, >70% of the patients required analgesic medication before discharge home from the day surgery unit. Although <10% of the patients developed postoperative emetic symptoms, one-third required antinausea medication. Although 90% of the patients were highly satisfied with the anesthetic technique, two of the patients who experienced "vivid dreams" would prefer to receive a different anesthetic for a future operation.

Discussion

The adjunctive use of nonopioid compounds reduced the need for traditional opioid analgesics during these painful procedures. Clonidine, ketorolac, and steroids all reduce opioid-related side effects and thereby improve recovery from anesthesia (6–8). Combining these nontraditional drugs with ketamine minimized the need for intraoperative fentanyl and reduced the risk of clinically significant respiratory depression during the procedure. Although both midazolam and propofol were administered during the procedure, 15% of patients still experienced ketamine-induced emergence reactions (described as "vivid but pleasant dreams").

This small series of cases demonstrates the feasibility of performing painful procedures under TIVA with minimal doses of potent opioid analgesics. The use of nonopioid anesthetic and analgesic drugs minimizes the risk of respiratory depression, as well as the adverse effects of these compounds on the central nervous system, gastrointestinal, and genitourinary systems. Given its rapid onset and ultra-short duration of effect, small bolus doses of remifentanil (10–20 μg IV) may be a useful alternative to fentanyl as a rescue analgesic during the transient painful aspects of these procedures (9). An investigational parenteral formulation of acetaminophen (propacetamol) could also prove to be a useful adjuvant to this TIVA technique (10).

In conclusion, the use of a combination of nonopioid IV anesthetics and analgesics to supplement local anesthesia provided an adequate depth of anesthesia for facial laser resurfacing without the need for supplemental oxygen or assisted ventilation.

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