reactions, confusion, or irrational behavior may occur up to 24 hours postoperatively and may be reduced by pretreatment with a benzodiazepine and the use of ketamine at the lower end of the dosing range. Rapid I.V. administration or overdose may cause respiratory depression, apnea, and enhanced pressor response. Resuscitative equipment should be available during use. Use with caution in patients with CSF pressure elevation, the chronic alcoholic or acutely alcohol-intoxicated. May cause dependence (withdrawal symptoms on discontinuation) and tolerance with prolonged use. May cause CNS depression, which may impair physical or mental abilities; patients must be cautioned about performing tasks which require mental alertness (eg, operating machinery or driving). When used for outpatient surgery, the patient be accompanied by a responsible adult. Should be administered under the supervision of a physician experienced in administering general anesthetics.

Anesthesia and Critical Care Concerns/Other Considerations

Clinical Pearls/Comments: Can produce emergence psychosis, including auditory and visual hallucinations, restlessness, disorientation, vivid dreams, and irrational behavior in 5% to 30% of patients; risk factors include age >15 years, female gender, dose >2 mg/kg I.V., and a history of personality problems/frequent dreams (White, 1982). Pretreatment with a benzodiazepine reduces incidence of psychosis by >50%. Spontaneous involuntary movements, nystagmus, hypertonus, and vocalizations are also common.

Bronchodilation is beneficial in asthmatic or COPD patients. Laryngeal reflexes may remain intact or may be obtunded. The direct myocardial depressant action of ketamine can be seen in stressed, catecholamine-deficient patients. Ketamine releases endogenous catecholamines (epinephrine, norepinephrine) which maintain blood pressure and heart rate, and increase myocardial oxygen demand. Ketamine increases cerebral metabolism and cerebral blood flow while producing a noncompetitive block of the neuronal postsynaptic NMDA receptor. It lowers seizure threshold and stimulates salivary secretions. Recent laboratoryclinical studies support the use of low-dose ketamine to improve postoperative analgesia/outcome (Adam, 2005; Menigaux, 2000).

Ketamine, because of its effects on cardiovascular sympathetic tone, is the anesthetic drug of choice for patients with cardiac tamponade and restrictive pericarditis. Relative contraindications include patients with increased ICP (spontaneously breathing), increased intraocular pressure/open globe, and patients with schizophrenia or psychosis. (S)-ketamine (ie, esketamine) is available in a preservative-free solution in Europe for intrathecal/epidural use; however, it currently is not approved by the FDA. Laboratory animal data has shown that ketamine accentuates apoptosis in newborn rat brains after cerebral ischemia/reperfusion (Mellon, 2007). Conversely, in adult animals, ketamine-induced neuroprotection may involve antiapoptotic and antinecrotic cell death. (Reeker, 2000). These data do not currently support a change in clinical practice.

Cardiovascular Considerations Ketamine, secondary to catecholamine release, increases blood pressure, heart rate, and cardiac output thereby increasing myocardial oxygen demand. The mechanism by which ketamine stimulates the cardiovascular system has yet to be elucidated. The use of concurrent benzodiazepine, inhaled anesthetics, and propofol or administration of ketamine as a continuous infusion may reduce these cardiovascular effects. Ketamine is a bronchial smooth muscle relaxant probably due to catecholamine release.

Adverse Reactions Frequency not always defined. Cardiovascular: Arrhythmia, bradycardia/tachycardia, hyper-/hypotension Central nervous system: CSF pressure increased Dermatologic: Erythema (transient), morbilliform rash (transient) Gastrointestinal: Anorexia, nausea, salivation increased, vomiting Local: Pain at the injection site, exanthema at the injection site Neuromuscular & skeletal: Skeletal muscle tone enhanced (tonic-clonic movements) Ocular: Diplopia, intraocular pressure increased, nystagmus Respiratory: Airway obstruction, apnea, bronchial secretions increased, respiratory depression, laryngospasm Miscellaneous: Anaphylaxis, dependence with prolonged use, emergence reactions (~12%; includes confusion, delirium, dreamlike state, excitement, hallucinations, irrational behavior, vivid imagery)