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Into The Land of Nod Drugs Used During Anesthesia in Day Surgery

By Marjorie Phillips, R.N.

Narcotic Analgesics/Opioid Antagonists

Narcotics activate opiate receptors in the central nervous system altering a patient's perception and response to pain. Their site of action is both brain and spinal cord neurons.

Morphine : A naturally occurring derivative of opium. Effective in relief of severe pain. Following I.V. injection maximum pain relief occurs 20 minutes after injection.² Analgesia is under 6 hours for parenteral morphine but persists up to 18 hours if spinal morphine is used. It causes respiratory depression usually noted as a decrease in respiratory rate. Perinasal and periorbital itching is common. With a morphine overdose pupil size becomes pinpoint.³ Nausea, biliary spasm which may mimic angina, histamine release, and urinary retention is also noted with the use of morphine.

Abstract

This paper lists and describes some of the drugs used during anesthesia in a Day Surgery Operating Room. The classification, action and implications of these drugs are addressed. The discussion is presented under the drug classes as Narcotic Analgesics/Opioids Antagonists, Opiate Antagonists, Induction Agents, Muscle Relaxants/Neuromuscular Blocking Agents, Inhalation Anesthetics, Cholinesterase Inhibitors, Anticholinesterases/Parasympathomimetics, Anticholinergics/Antimuscarinics/Parasympatholytics, and Antiemetics.

Meperidine (demerol) : Synthetic. For use in moderate to severe pain. Like morphine, it causes respiratory depression and has many of the same side effects common to morphine such as nausea. It must not be used for patients taking, or have taken within 14 days, monoamine oxidase inhibitors since a potentially lethal response can occur. In PARR demerol is used to combat shivering.

Fentanyl (sublimaze) : Synthetic, 80 to 100 times more potent than morphine.⁴ Adjunct to general anesthesia. It has a rapid onset, and in low doses, a short duration of action.² Less emetic activity is noted with the use of Fentanyl² compared to morphine. No histamine release.⁵ Causes little change in blood pressure, cardiac output and systemic vascular resistance⁵, therefore it is used for patients with cardiac disease. It does share with many narcotics a marked respiratory depressant effect, particularly profound because of its rapid onset of action.⁴

Alfentanyl (alfenta) : Synthetic. Adjunct to general anesthetic. Possesses a very short half life.² It does not cause histamine release.⁵ Can cause respiratory depression. Maximal activity within 120 seconds of injection.

Codeine : Naturally occurring.³ For mild to moderate pain. Can cause respiratory depression. Other adverse effects include those seen with morphine, e.g. hypotension, bradycardia, nausea, vomiting, dry

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mouth, urinary retention, pruritis. It is often used to treat an unproductive cough.³

Spinal Narcotics : Used for post-operative pain control. The most common injection sites are the epidural space and the lumbar subarachnoid space. Diffusion of narcotics out of the spinal cord depends on their lipid solubility.⁵ Morphine is the least lipid soluble of the narcotics and thus lingers longest in the cerebral spinal fluid.⁶ Onset is 30 to 60 minutes and duration is from 12 to 24 hours.⁶ The drugs are metabolized in the liver and a small amount is excreted by the kidneys.⁵ The side effects are the same for epidural and spinal narcotics as they are for other routes e.g. respiratory depression, urinary retention, nausea, vomiting, and pruritis but may be delayed up to 24 hours. A rare complication of epidural analgesia, not attributed to morphine, is the formation of a hematoma in the epidural space.⁶ This problem is associated with inherited clotting deficiencies or administration of anticoagulants.⁶ An abscess is also rare and presents as does the hematoma with back pain and leg weakness with the addition of paraesthesia and fever.⁶ The symptoms from hematoma may appear within hours or several days following the procedure.

Opiate Antagonists

Act by direct competition at opiate receptors in the central nervous system.¹

Naloxone (narcant) : Reverses the depressant effects of narcotics. Results can usually be seen in one to two minutes. Incremental doses are repeated until reversal is complete. Dependent upon the relative amounts of Naloxone and opiate present, it is effective from 45 minutes to four hours. Long acting or high serum concentrations of narcotics may outlast the Naloxone and respiratory depression may return. Any dose might eliminate the analgesic effect of the narcotic resulting in pain with elevated blood pressure and tachycardia in response. A rapid reversal may induce nausea, vomiting, tachycardia, arrhythmias and diaphoresis.⁴ There have been no reported experiences of overdose.²

Induction Agents

Propofol (diprivan) : A relatively new anesthetic-sedative. It acts rapidly and smoothly within 40 seconds. It has a high metabolic clearance resulting in a 34

to 66 minute half life. When used for induction and maintenance, upon discontinuation of infusion, most patients are responsive to verbal command and oriented in 7 to 8 minutes. However, as with any anesthetic, patients must not engage in activities requiring alertness such as driving. The formula contains soybean oil and egg lecithin and has no preservatives. Our patients are asked if they are allergic to eggs or soybeans. Once opened, it must be used or discarded within 6 hours.

Propofol does not cause histamine release. It does cross the placenta and is detectable in human milk. Despite antiseizure properties, tonic clonic movements have been reported during Propofol anesthesia. Alfentanil concentrations are higher than expected with the use of Propofol. It is metabolized chiefly in the liver and is excreted by the kidney.

The above is adapted from: *The product information sheet, Zeneca Pharmacy, Mississauga, Ont., 1990.*

There is significant antinausea and antipruritic effects with propofol use. Dreaming is very common, most notably erotic dreams. Patients often have happy expressions and say that they had a good dream. Those who volunteer information about the dreams admit to gardening, holidays, their family, nothing startling!

Thiopental Sodium: (pentothal) A short acting intravenous barbiturate.

Peak action is 50 seconds. It has a very high PH of 10.6 and causes tissue irritation that may cause necrosis when extravascular. Recovery is rapid with residual somnolence and retrograde amnesia.² It penetrates all tissues of the body, and is metabolized mainly by the liver.

Ketamine (ketalar) : It is a rapid acting dissociative anesthetic. It blocks only the pain conduction and perception portions of the central nervous system. It has a bronchodilating effect, generalized increase in sympathetic tone is noted and pharyngeal and laryngeal reflexes may remain intact.⁴ Adults may experience bad dreams, children are not as susceptible to these disturbances. With I.V. administration, recovery is about 30 minutes.⁴

Midazolam (versed) : A water soluble benzodiazepine anesthetic, sedative, premedicant with central nervous system depressant effects. It can produce sedative-hypnotic effects, induce anesthesia and anterograde amnesia.² When questioned about surgery time, patients consistently report far less time taken than was the case.

Sedation following I.V. injection is about 3 to 6 minutes and recovery within two hours.² Patients are

cautioned against driving and operating machinery. It requires a longer time for fat patients and patients with congestive heart failure, liver or kidney problems to eliminate Versed. Erythromycin increases and prolongs the effects of Versed.²

Muscle Relaxants/Neuromuscular Blocking Agents

Muscle relaxants interfere with the transmission of nerve impulses at the myo-neural junction. Muscles contract when an impulse causes acetylcholine to be released by a nerve (axon), which then cross the space between a nerve and a muscle and activates the receptor site of a muscle. The acetylcholine is quickly destroyed by the enzyme acetylcholinesterase thus opening the muscle receptors.

Anaesthetists use two types of blocking agents to cause muscle relaxation, depolarizing and non-depolarizing neuromuscular blocking agents. The depolarizing muscle relaxants cause a contraction before relaxation. They cross the cleft between nerve and muscle and activate the receptor site causing a contraction. The enzyme pseudocholinesterase is needed to break down these drugs. This is a much slower process than acetylcholinesterase breaking down acetylcholine. Thus the muscle can not be stimulated again until the depolarizing drug has cleared. This takes 3 to 5 minutes.

The non-depolarizing muscle relaxants do not cause a contraction before relaxation. They cause relaxation of the muscle by achieving a tissue concentration greater than acetylcholine and therefore are able to overwhelm the receptor sites of the muscle. Hence, the muscle cannot be stimulated. These drugs can be reversed with anti-cholinesterases.

Succinylcholine (anectine) : It is a depolarizing muscle relaxant used mainly for short procedures requiring relaxation such as intubation, bronchoscopy and esophagoscopy. If the patient is unable to metabolize this drug, they will need post-operative ventilation. Two to twelve hours is sometimes necessary for anectine to be metabolized. Potassium is released into the extracellular space with the use of anectine. In some cases with exaggerated release high serum potassium levels result in cardiac arrests.

The above information on muscle relaxants is adapted from : Marshall M., Module 1, *Physiological*

Effects of General Anesthesia, Vancouver Community College, 1987.

Pancuronium (pavulon) : Nondepolarizing relaxant of medium duration, (just under one hour), can be used for intubation, peak action is 3 minutes.² It has the ability to increase the heart rate.⁵ Pavulon is potentiated by inhalation anesthetics, hypokalemia, some cancers, and certain antibiotics.²

Tubocurarine (tubarine) : Nondepolarizing. Causes significant histamine release. Some antibiotics and diuretics increase its duration of action and potency.²

Atracurium (tracrium) : Nondepolarizing. Produces dose dependent histamine release. In combination with high doses of narcotics bradycardia and asystole can occur. Onset is 3 to 5 minutes and in 20 to 35 minutes 75% or more of the effects of tracrium have been eliminated.⁵

Vecuronium (norcuron) : Nondepolarizing. There is no histamine release. Onset time is 3 to 5 minutes. 75% recovery in 20 to 35 minutes. It is metabolized by the liver.⁵

Metocurine Iodide (metubine) : Nondepolarizing. Onset takes 2 to 8 minutes. Duration is variable, from 60 to 82 minutes. Mainly excreted unchanged in the urine. Associated with histamine release.⁵

Inhalation Anesthetics

These agents produce a state of unconsciousness and muscle relaxation.

Nitrous Oxide: Nitrous oxide is the most commonly used anesthetic gas. It is non potent and is used to potentiate other drugs used during anesthesia⁶ Used alone it will increase blood pressure. Nitrous oxide is the least soluble in blood of the inhalation anesthetics and therefore has a faster onset and recovery than Halothane or Isoflurane.⁷

Halothane (fluothane) : A potent sweet-smelling volatile liquid anesthetic. It causes bradycardia, decreased blood pressure and reduced tidal volume. Patients often shiver when emerging from this anesthetic. A small amount is metabolized by the liver, but it is excreted mostly by the lungs. Repeat exposure may cause hepatic necrosis.

Isoflurane (forane) : A potent volatile anesthetic



supplied as a clear liquid. It is a respiratory depressant and irritant. Isoflurane does not markedly disturb cardiovascular stability. It is thought to be non-toxic to the liver and kidneys.

Cholinesterase Inhibitors/Anticholinesterases/Parasympathomimetics

These inhibit the breakdown of acetylcholine and therefore reverse nondepolarizing skeletal muscle relaxants.⁸

Neostigmine (prostigmin): The half life is 51 to 91 minutes. It is excreted mainly by the kidney.² It can cause, if improperly administered, bradycardia, asystole, nausea, vomiting, abdominal cramps, increased bronchial secretions, diaphoresis, and weakness.²

Pyridostigmine (regonol) : Its action is immediate. About 80% of the I.V. dose is excreted in the urine within 24 hours.² Improper administration causes the same effects as Neostigmine with the addition of central nervous system reactions such as: anxiety, restlessness, vertigo, headaches, drowsiness, confusion, cheyne-stokes breathing, coma, convulsions.²

Edrophonium (tensilon) : It has a rapid onset and renal excretion accounts for 75% of its elimination

with the liver metabolizing 30%.⁵ Edrophonium can cause bradycardia, hypotension and augment secretions of the bronchial, lacrimal, salivary, gastric and sweat glands.

Physostigmine (antilirium) : It crosses the blood brain barrier and increases central nervous system acetylcholine levels making it useful for depression caused by atropine, and scopolamine with partial antagonism of other anesthetic agents.⁸ The primary use is for atropine poisoning. The side effects are the same as those found with other cholinesterase inhibitors.

Anticholinergics/Antimuscarinics/Parasympatholytics

These drugs act by blocking the action of acetylcholine or other cholinergic stimuli.² They are excreted unchanged in the urine.²

Atropine Sulfate: Used for the relaxation of gastro intestinal, biliary and genitourinary tracts and the suppression of salivary, gastric and respiratory tract secretions.² It increases the heart rate by blocking the effect of the vagus nerve; this action counteracts the bradycardia caused by inhalation anesthetics or surgical stimulus. Atropine decreases sweating and can result in bright red babies from compensatory vasodilation.

Glycopyrrolate (robinul) : It has a longer duration of action than atropine. It does not cross the blood-brain barrier. It is also used as a reversal agent of nondepolarizing muscle relaxants, as it protects against bradycardia and excessive secretions which neostigmine and pyridostigmine do not.²

Antiemetics

Droperidol (inapsine) : This drug is also a neuroleptic. It has a rapid onset and the duration of action is generally 2 to 4 hours. It is metabolized in the liver and excreted in the urine and bile.² It can cause spastic movement, tremors, chills, vertigo, facial sweating, hypotension and tachycardia.² Inapsine potentiates narcotics, barbiturates, tranquilizers and alcohol, hence in tends to prolong post anesthetic recovery.

Dimenhydrinate (gravol) : It is used for post-operative vomiting and drug induced nausea. Gravol causes drowsiness.

Local Anesthetics

Local anesthetics may contain epinephrine hydrochloride (adrenalin). It is a sympathomimetic drug, with a rapid onset and short duration of action. It is metabolized by the liver and excreted in the urine.² It increases the cardiac output, raises systolic blood pressure and at low doses lowers diastolic and sometimes systolic blood pressure. Smooth muscle of the bronchi are relaxed and thus it is an antagonist of histamine.² Do not use in end organs such as fingers, toes, ears, nose, or penis as vasoconstriction may cause necrosis.

Lidocaine Hydrochloride (xylocaine) : It is often used because it is potent, has a rapid onset and a moderate duration of action. It can depress or stimulate the cerebral cortex and medulla producing drowsiness, nervousness, dizziness, blurred vision, nausea, tremors, convulsions, respiratory and cardiac arrest.²

Bupivacaine (marcaine) : It is valued for its long duration of action,⁵ up to 16 hours. There is also a period of analgesia after the return of sensation.² Excessive plasma levels of marcaine cause the same signs and symptoms that xylocaine produces though it has significantly higher cardiac toxicity.

Cocaine: It is well absorbed across the mucous membrane and has a half life of about one hour.⁵ It inhibits the reuptake of norepinephrine resulting in

the signs and symptoms of the sympathetic nervous system.⁵ In the central nervous system, cocaine is initially stimulating producing euphoria, excitation, tremors, seizures, and emesis following which the patient may experience depression and respiratory failure.⁵ Moderate doses elevate blood pressure and heart rate.⁵ Dysrhythmias, hyperglycemia, hyperthermia and myocardial infarction can also occur.⁵ Because of swallowed cocaine used in nasal surgery significant effects can be manifest from gastric absorption.

Conclusion

Used judiciously, the drugs discussed in this paper ensure a safe and effective anesthetic and smooth recovery for patients going through Day Surgery operating rooms.

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