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Procedural Sedation in the ED

While on my rotation at Children's we performed many procedures using different sedation medications. Most often, we used ketamine to sedate kids for procedures such as fracture reductions and extensive laceration repairs. There are a growing number of procedures being performed in the ED and outside the operating rooms and an increasing number of sedative agents are being used in order to provide anxiolysis, analgesia, and amnesia. I decided to review the different procedural sedation agents used in the ED, notably ketamine, and familiarize myself with the efficacy and safety issues associated with each.

First, it is important to understand the definition of each of the three levels of sedation defined by the American Society of Anesthesiologists. Minimal sedation is a drug-induced state characterized by **anxiolysis and normal responses to voice and normal cardiac and respiratory functions**. Moderate (conscious) sedation/analgesia is defined by a **depressed level of consciousness with responsiveness to verbal commands and cardiac and ventilation function is preserved**. Deep sedation and analgesia produces a **depressed level of consciousness that is not easily arousable and requires repeated painful stimuli for response. Cardiac function is usually maintained and ventilation may be impaired, requiring assistance when spontaneous ventilation is inadequate**.

Benzodiazepines are used most commonly for procedural sedation (PSA) given their amnestic, analgesic (controversial), and anxiolytic effects produced by GABA-mediated chloride influx in the CNS. **Versed** is used most often due to its faster onset (5 min) and short action (30-45 min). Ativan can also be used but has a slower onset and longer duration. **Opiates are usually added** to provide additional analgesia and sedation during painful procedures. **Fentanyl** is preferred due to its immediate onset of action, short duration (30-90 min), and lower propensity to cause respiratory depression and hypotension. When benzodiazepines are **combined** with alcohol or opioids, the sedative and respiratory-depression effects are greatly increased.

Ketamine elicits a dissociative and amnestic effect that causes minimal respiratory depression, as it does not affect pharyngeal-laryngeal reflexes and allows for spontaneous respiration. It can, however, cause increased intracranial pressure (not clinically relevant), **hypersalivation, laryngospasm, and a hallucinatory emergence reaction** in older children and adults. It is also a direct myocardial depressant and vasodilator. Onset of action occurs within one minute (IV) and lasts about 10-15 mins. Atropine can be used to control hypersalivation. Emergence delirium reactions are estimated in 12% of adults and present with hallucinations, confusion, and irrational behavior; can last from 1-3 hours. It has been studied that incidence of this reaction can be significantly decreased by using a **benzodiazepine**, commonly versed, in conjunction with ketamine in adults. It was found in a study that this **might be unnecessary in pediatric populations**, as there is a lower incidence of this reaction and that recovery agitation in kids is more likely associated with the degree of pre-procedure agitation.

Propofol provides potent but short -acting sedation and anesthesia, but does not reliably produce amnesia or analgesia in PSA; therefore, an adjuvant sedative may be needed. Onset of action is rapid with a peak affect at 90-100 seconds and onset is dose-dependent, ranging from 5-10 minutes. It leads to a **dose-dependent decrease in SBP and cardiac output of 25-40%**. **One-to-one mixtures of propofol and ketamine are being used in adults for sedation and analgesia and associated with a decrease in incidence of emergence delirium**, decreasing the need for adjuvant benzodiazepine use.

Etomidate is an ultra-short acting sedative (20-30 second onset) with minimal cardiovascular and respiratory depression. This agent transiently lowers cerebral blood flow by 20-30% and reduces intracranial and intraocular pressure. Its major adverse effect is **adrenal insufficiency with long-term infusions and nausea and vomiting with infusion**.

It is important to monitor patients carefully undergoing PSA due to their potential cardio-respiratory depression affects. Suction, oxygen, airway management equipment, resuscitation medication/equipment, and IV access should all be in place for these patients. Careful oxygen and BP monitoring should be done and capnography considered for high-risk patients. In addition, reversal agents such as naloxone and flumazenil should be readily available when using opioids and benzodiazepines respectively.

References

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