Pediatric Rapid Sequence Intubation: Intraosseous Style

Scott DeBoer, RN, MSN, CFRN, and Debi Zeglin, RN, BSN, CCRN

Air medical transport was requested to the scene of a multiple victim accident in which a car had struck a tree. On arrival, the flight crew found a 2-year-old girl with severe head and abdominal injuries as evidenced by clenched teeth, decerebrate posturing, and intermittent seizure activity. Attempts at peripheral intravenous (IV) access by prehospital paramedics and the flight crew were unsuccessful. Therefore an 18 g intraosseous (IO) needle was placed in the child's proximal tibia. On verification of placement, fluid resuscitation was begun with isotonic fluids. Rapid sequence intubation (RSI) medications, including atropine, lidocaine, midazolam, fentanyl, and succinylcholine, also were administered through the 10 line. The child then was orally intubated, and ventilatory support was initiated. The remainder of the flight was uneventful, as was her hospitalization. She was discharged home, alert and playful, after 10 days in the medical center.

RSI involves using medications to pharmacologically aid intubation.[1-3] Although the "I'm bigger and therefore 1win" technique of airway maintenance can be used with children, RSI benefits include increased success rates, less intracranial pressure (ICP) alterations, and decreased stress (physical and emotional) for patients, families, and staff members.[3] The goal of RSI is to quickly obtain "ideal" intubating conditions while minimizing the potential for aspiration and hemodynamic instability. This goal is accomplished by pharmacologic paralysis, preceded by appropriate sedative and analgesic medications.

Chemical paralysis aids intubation by relaxing the airway musculature so it can be easily manipulated.[1] However, chemical paralysis is not without its share of risks. One obvious risk is that the patient is not breathing while paralyzed. If proper placement of the endotracheal tube (ETT) is accomplished quickly, everyone concerned can breathe easy. However, if intubation cannot be accomplished for whatever reason, bag/valve/mask ventilations must be performed until the paralytic has worn off or a definitive airway bas been established.[3]

This concern over ETT placement is one of the rationales for using short-acting muscle relaxants for RSI induction. Succinylcholine has an approximate onset of 30 to 60 seconds, with a paralysis duration of 3 to 12 minutes.[3] Contrast this with Pavulon (pancuronium), whose duration can be upward of 60 minutes.[3] After the airway has been secured, longer-acting paralytics may be administered appropriately because respiratory depression no longer is a concern.

Clinicians must remember that muscle relaxants do only as their title describes-relax the muscles. They provide no sedation, no analgesia, and no anxiolysis. This relaxation results in the horrifying state of being "paralyzed." Imagine being 2 years old, intubated, in pain, and chemically paralyzed. You try to cry but cannot. You try to move but cannot. The only indications that you are awake and in pain are your tears and increasing heart rate/blood pressure. To avoid this ordeal for both children and adults, paralytics should be preceded by and given concurrently with analgesics and/or sedatives. Typical analgesics used include morphine, fentanyl, and ketamine. Sedative medications include rnidazolam, thiopental, etomidate, or ketamine. Most sedatives (except ketamine) do only that-sedate. Pain relief, if any, is minimal. Therefore, if sedation and analgesia are required, both categories of medications should be administered.[1]

"Pretreatment" for RSI can involve various medications as time and the clinical status of the child permits. Atropine is given to help dry oral secretions and minimize the bradycardic effects of succinylcholine and vagal stimulation of the airway. In addition to atropine, lidocaine can be administered before intubation to potentially decrease the ICP increases associated with intubation.[1] Lastly, some advocate the use of a "defasciculating dose" of a neuromuscular blocker: one-tenth the full paralytic dose of the longer-acting muscle relaxant to be administered after tube placement bas been confirmed. Like lidocaine, this is given before intubation to minimize ICP fluctuations by minimizing the fasciculations or "twitches" associated with succinylcholine.[1]

In addition to medications, in the preintubation setting, clinicians must assume that every patient has a full stomach. Therefore, if the patient's clinical situation permits, hyperoxygenation is accomplished by administering 100% oxygen through a nonrebreather mask. In conjunction with the Sellick maneuver (cricoid pressure), this action allows for self-hyperoxygenation in

Category	Drug	Dose IV/ID	Onset	Duration
Paralytics	Succinylcholine (Anectine)	2 mg/kg	30-60 sec	3-12 min
	Vecuronium (Norcuron)	0.1 mg/kg	1-4 min	30-45 min
	Pancuronium (Pavulon)	0.1 mg/kg	1-5 min	50-90 min
	Rocuronium (Zemuron)	0.6-1.0 mg/kg	50-90 sec	25-60 min
	Atracurium (Tracrium)	0.5 mg/kg	2-4 min	20-45 min
Sedatives	Midazolam (Versed)	0.1 mg/kg	1-2 min	30 min
	Ketamine (Ketalar)	1-2 mg/kg	1-2 min	15 min
	Thiopental (Pentothal)	3-5 mg/kg	30 sec	5 min
	Etomidate (Amidate)	0.3 mg/kg	1 min	10 min
Analgesics	Morphine	0.1 mg/kg	2-5 min	30-60 min
	Fentanyl (Sublimaze)	1-5 meg/kg	1-2 min	20-30 min
	Ketamine (Ketalar)	1-2 mg/kg	1-2 min	15 min

PRETREATMENT MEDICATIONS

Drug	Dose IV/10
Lidocaine	1.5 mg/kg
Atropine	0.02 mg/kg (minimum 0.1 mg)
Vecuronium (Norcuron) or Pancuronium (Pavulon)	0.01 mg/kg (defasciculating dose)

the spontaneously breathing patient, minimizing the potential for adverse events associated with bag/valve/mask ventilation, including gastric distention and aspiration?

When given intravenously, the above medications for RST have been well described in the literature for both pediatric and adult patients. However, little documentation exists about using the TO route to administer these medications for RSI. Although the technique of 10 infusion has been known for years, not until relatively recently has it made a resurgence in pediatric emergency care. Literature reviews reveal that any pediatric resuscitation medication can be administered through an 10 line with comparable results and effects as if given intravenously.6-'[4]

In summary, RST, once restricted to the operating room, has become a standard in emergency airway management techniques. In critically ill children, peripheral IV access may be difficult to obtain. This case and literature review illustrate that, in the event an emergency intubation is needed and IV access to administer medications is not available, 10 access can be an acceptable route for RSI.

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Authors' note: The information provided in the boxes is presented as a guide and should not be regarded as medical advice.

Scott DeBoer, RN, MSN, CFRN, and Debi Zeglin, RN, BSN, CCRN, are flight nurses with University of Chicago Aeromedical Network (UCAN) at the University of Chicago Hospitals in Illinois.

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