

Unilateral Mydriasis in Helicopter EMS

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OBJECTIVE

1. Review pediatric asthmatic cardiac arrest case to understand the pharmacology of ipratropium bromide in producing unilateral mydriasis
2. Review differential diagnosis of unilateral mydriasis

Method

1. Retrospective case report of EMS, HEMS, ED, and pediatric critical care medical records

CASE BACKGROUND

Medical History

- 14-year-old, 50 kg female
- **PMH:** severe uncontrolled asthma, prior hospital admission in last two months, no prior intubations or ICU stays, eczema
- **Medications:** long-acting B2A/ICS, Flonase, Claritin, Montelukast, frequent albuterol use
- **Allergies:** NKDR, environmental allergies
- **Social:** lives on farm with cows

HPI

- Typical morning, drives herself to school for rural track meet
- Offboards the school bus and begins to “gasp”
- Witnessed cardiac arrest
- School nurse administered IM epinephrine and CPR
- CPR for 15 minutes, AED (non-shockable)
- ALS EMS continues care with mechanical CPR, epinephrine, albuterol, ipratropium, oxygen, and crystalloid
- ROSC: transported to critical access hospital

HPI: Emergency Department

- RSI with Rocuronium and Ketamine
- **VBG:** pH: 6.82, paCO₂: 98, paO₂: 120, HCO₃: 16, BE: -18
- Received mechanical ventilation, continuous nebulized albuterol with ipratropium bromide, methylprednisolone, racemic, intramuscular, and continuous infusion of epinephrine, magnesium sulfate & aminophylline bolus with maintenance infusion, and fentanyl drip
- HEMS requested for transport to tertiary pediatric intensive care

CASE BACKGROUND CONTINUED

HPI: HEMS

- EC135-T2+ with IFR
- Airtime 1:46 (headwind) vs. ground time 4:00
- Total critical care time: 2:37
- Continued epinephrine, theophylline, & ketamine drip
- Maintained continuous albuterol
- Supplemented sedation with 25 mg Ketamine & Fentanyl IVP due to Vecuronium prior to departure
- Continued ventilation with Hamilton T1 using PCV+, 4-6 ml/kg IBW due to high pPeak, and acidosis VE strategy, targeting an I:E of 1:4 to 1:5 to minimize auto peep

Unilateral Mydriasis

- ≈ 20 into transport, reassessment revealed left side 9mm blown pupil unresponsive to light stimulus
- No other changes; right pupil 3mm
- Confounding & concerning considering patients atraumatic HPI and neurological exam
- 250ml bolus 3% Hypertonic Saline
- Increased minute ventilation to titrate ETCO₂ 30-35 mmHg
- Patient remains otherwise stable

Outcome

- CT scan was unremarkable for neurological sequela
- Mydriasis self-resolves
- Discharged after 11 days great neurological recovery
- **Primary suspicion:** direct ophthalmic exposure during ET tube administration of ipratropium by referring
- **Additional exposure routes:** poor mask seal with inline BVM, damaged nebulizer equipment, exposure during refilling of the nebulizer canister, or transitioning to the transport ventilator

Discussion

Immediate Differential

- **(1) Cerebral herniation:** ↓LOC, Cushing Triad (wide pulse pressure hypertension, bradycardia – baroreceptor reflex, irregular respiration–brain stem compression), fixed/dilated pupil(s), decorticate & decerebrate posturing, vomiting, seizure
- **(2) Hypoxic Ischemic Encephalopathy:** vasogenic & cytotoxic fluid shifts via reperfusion injury & reactive oxygen species – progression to to herniation is rare

Ipratropium Pharmacology

- Acetylcholine key parasympathetic mediator of nicotinic & muscarinic receptors
- Ipratropium = anticholinergic = muscarinic receptor antagonist
- Blockage of acetylcholine in the eye results in unopposed sympathetic innervation = blown pupil
- Reduces bronchoconstriction, goblet cell mucus production, and inflammation

Ipratropium Mydriasis

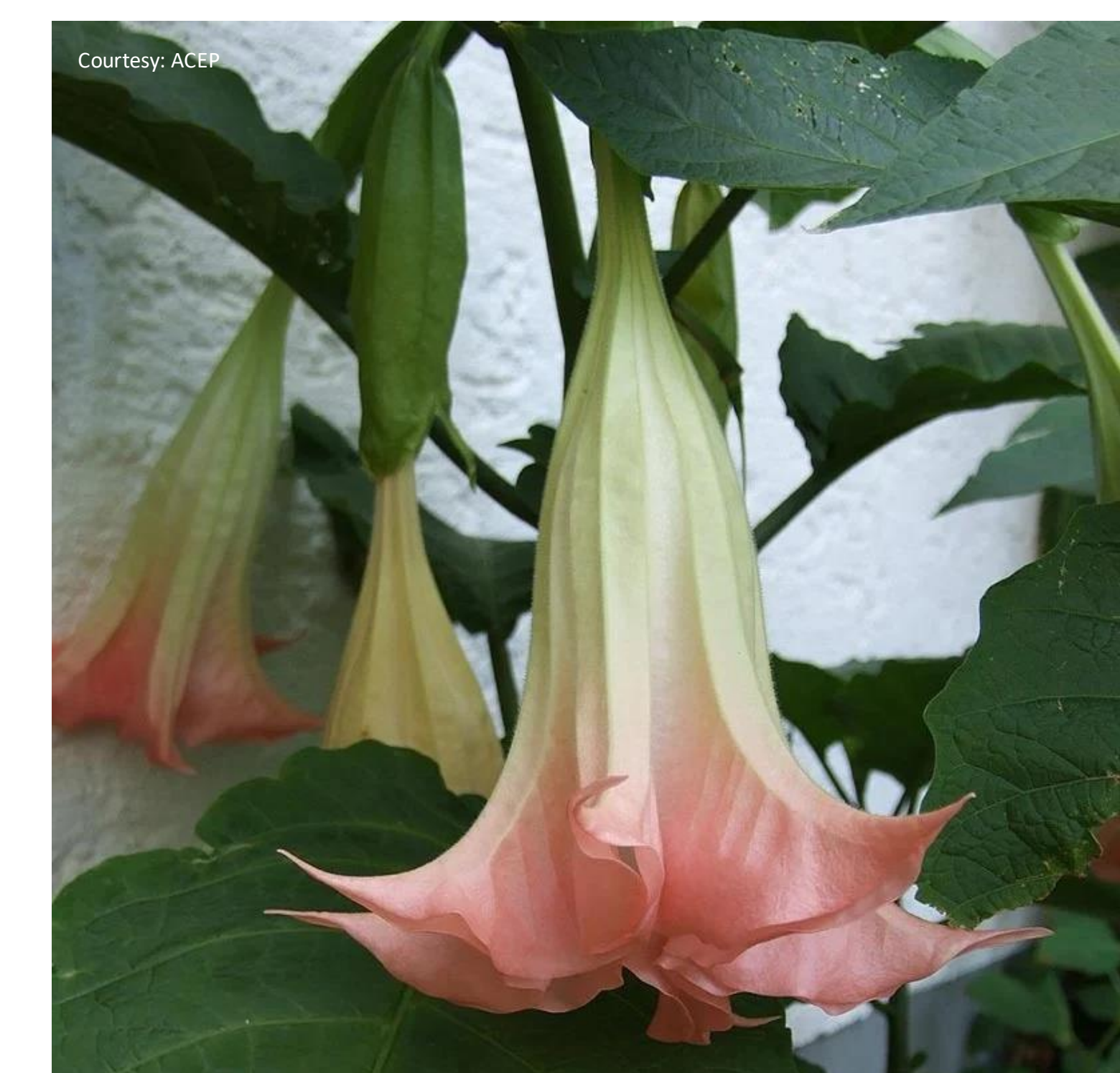
- Commonly reported in literature, remains frequently overlooked
- Lead to unnecessary imaging studies, creates anxiety, confounds the differential

Expanded Differential

- **Pharmacological Agents:** (1) Scopolamine, (2) Atropine, Glycopyrrolate Cream (axillary hyperhidrosis)
- **Plant Toxins:** tropane alkaloids – scopolamine, atropine, daturine, stramonine
- **Anticholinergic Toxic Syndrome:** bilateral blown pupils



Belladonna “Nightshade” with “Devil’s Cherries”



Angel's Trumpet



Datura (Moonflower, Jimson weed, Thornapple)