Eye of the Storm:
induction techniques in children

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Goals of the pediatric induction

- safety
- efficiency
- acceptance
- outcome

Pediatric induction: overview

- evaluation and preparation
- decision to use premedication
- involvement of parents
- choice of induction
- special situations
- measurement of outcome
  - safety (stable transition to maintenance)
  - “hidden” psychological morbidity

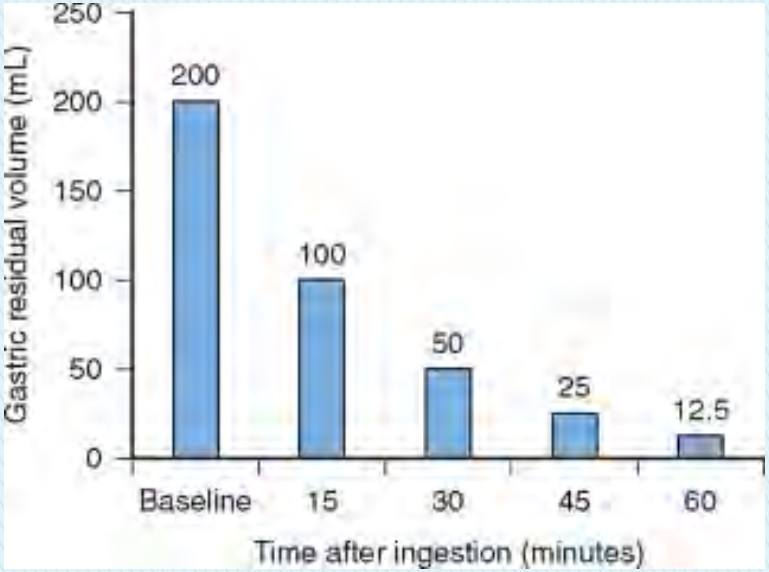
Evaluation and preparation: medical issues

- history and physical exam
  - airway, complex issues (consult needed?)
- anesthetic history
- most lab-work unnecessary
  - ± pregnancy, coags, C-spines (TRI 21)
- optimized? (potential consultation)
- NPO guidelines

NPO guidelines

ingestion	NPO interval
clear fluids	2 hours
breast milk	4 hours
infant formula	6 hours
milk/solids	6-8 hours

Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: a report by the American Society of Anesthesiologist Task Force on Preoperative Fasting. *Anesthesiology* 1999



Hunt JN, MacDonald M: J Physiol 1954; 126:459-474.)

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Advantage to clear fluids day of surgery

- diminished hunger and thirst
- easier compliance
- decreased risk hypoglycemia
- decreased risk of hypotension
- OR delays not as devastating
- happier, more cooperative child

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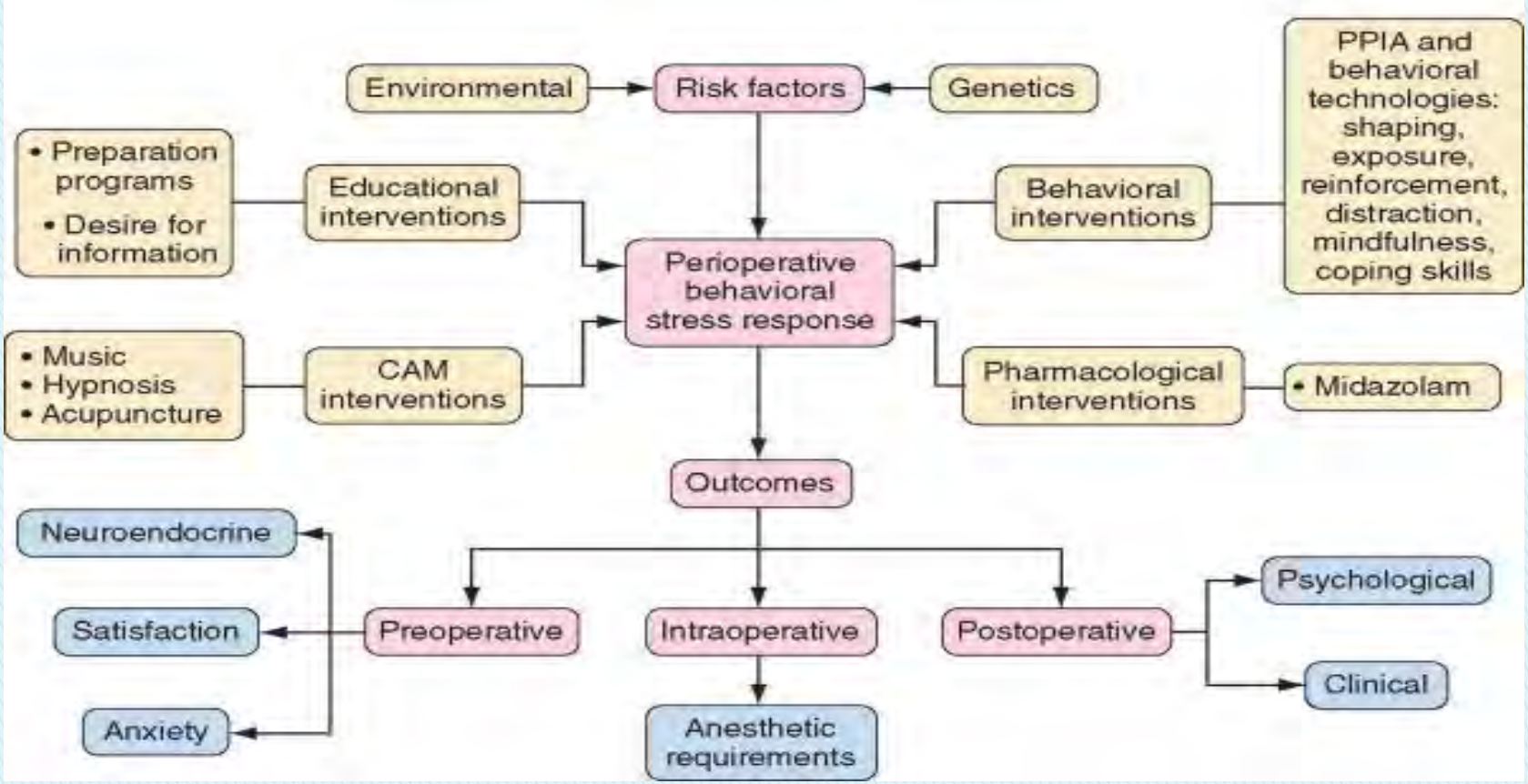
Evaluation and preparation: psychological issues

- postoperative regressive changes correlate w/preoperative anxiety (as high as 40-60%)
- preoperative anxiety a function of genetics, parenting, past medical experiences
  - a function of age and cognitive development
  - ↑ risk with attachment issues, shy temperament
- preoperative anxiety may correlate with postoperative excitement and ↑ pain scores

Perioperative behavioral stress: overview



The role of preoperative education in allaying anxiety

- evolving methods of delivery
- education may allay specific fears
  - fear of needles
  - fear of hunger and thirst
  - fear of separation
  - fear of being awake in OR
  - loss of autonomy
- Fortier: majority of children (age 7-17) desire information, especially about pain *

* *Anesth Analg* 109:1085;2009

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Psychological preparation: the preoperative visit

- individual attention and formulation of a plan
- informed consent (risk) and assent
- specific "rehearsal" for the day of surgery
- improved anxiety scores & quality induction
  - Varughese. *Anesth Analg* 2008; 107:413
  - Vetter. *Anesth Analg* 1993:77:96
  - Vernon – meta-analysis: fewer postoperative behavior Δ's (*Dev Behav Pediatr* 1993;14:36)

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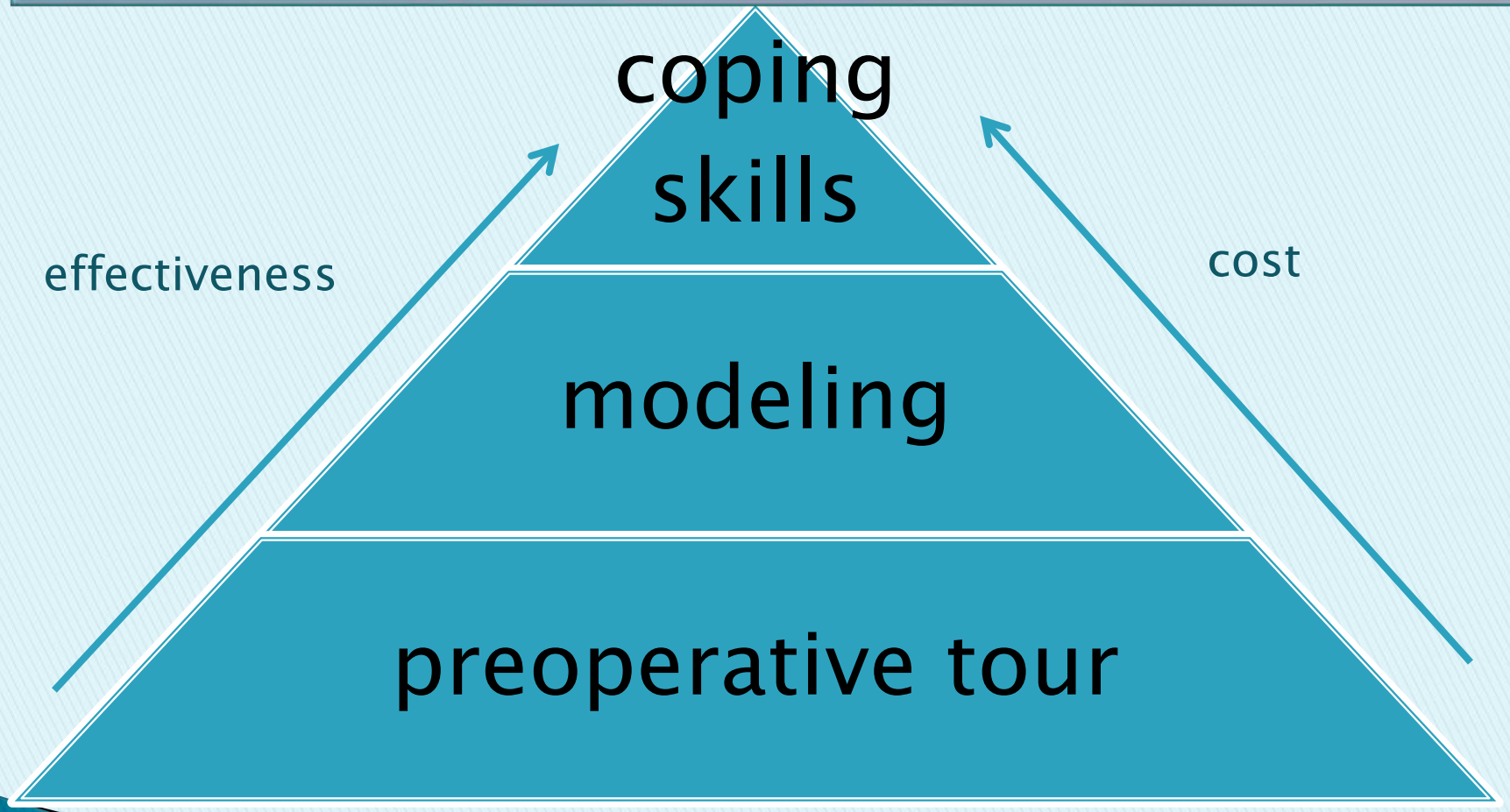
Preoperative education:
potential interventions



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Family-centered preoperative program (ADVANCE)

- Anxiety ↓
- Distraction
- Video model
- Add parents
- No excessive reassurance
- Coach parents
- Exposure of child (shaping)

n	Cont 99	Midaz 98	PPIA 94	ADV 96	p *
HU Anxiety M-YPAS	36	37	35	31*	.001
Mask Anxiety M-YPAS	52	40*	50	43*	.018
PACU Fentanyl (ug/kg)	1.37	1.23	0.81*	0.41*	0.16
PACU (m)	120	129**	122	108*	0.40

Kain. *Anesthesiology* 2007; 106:65

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The day of surgery

- review history / update / NPO status
- introduce new faces and address concerns
- diversions (Child-Life) in holding unit
- evaluate need for premedication
- prepare parent for induction
- allow familiar objects into the OR

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Factors predictive of poor compliance with inhaled induction

- ages 1–13; parents present; premedication at discretion of anesthesiologist (25% overall)
- poor compliance in 21% -- risk →
  - age < 4
  - prior anesthetics (risk in older kids, not younger)
  - lack of preoperative tour
  - anxiety level in HU
  - less time in HU ("no-wait" ↓ compliance)
  - no benefit to midazolam pre-medication

Varughese et al. *Anesth Analg* 107:413;2008

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Premedication: an overview

- infrequent at HCH (~ 25% nationwide)
  - usage varies inversely with PPIA
- oral midazolam most common (80–90%)
  - higher doses will hasten onset but prolong effect
  - alternatives include ketamine, ∂-2 agonists
- side effects rare but can be troublesome
- cost measured in both drug and personnel

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Premedication: dosing

DRUG	ROUTE	DOSE (mg/kg)
midazolam	oral nasal /SL rectal	0.25-0.75 0.2-0.4 0.5-1
ketamine	oral nasal rectal IM	3-6 3 6-10 2-10
methohexital	rectal (10%)	20-40
clonidine dexmedetomidine	oral nasal	0.004 (4 mcg) 0.002 (2 mcg)

Potential role for premedication

PRIMARY ROLE	SECONDARY ROLES *
allay anxiety	block vagal reflexes ↓ airway secretions anterograde amnesia ↓ aspiration risk facilitate induction provide analgesia

* historical indications predominate here

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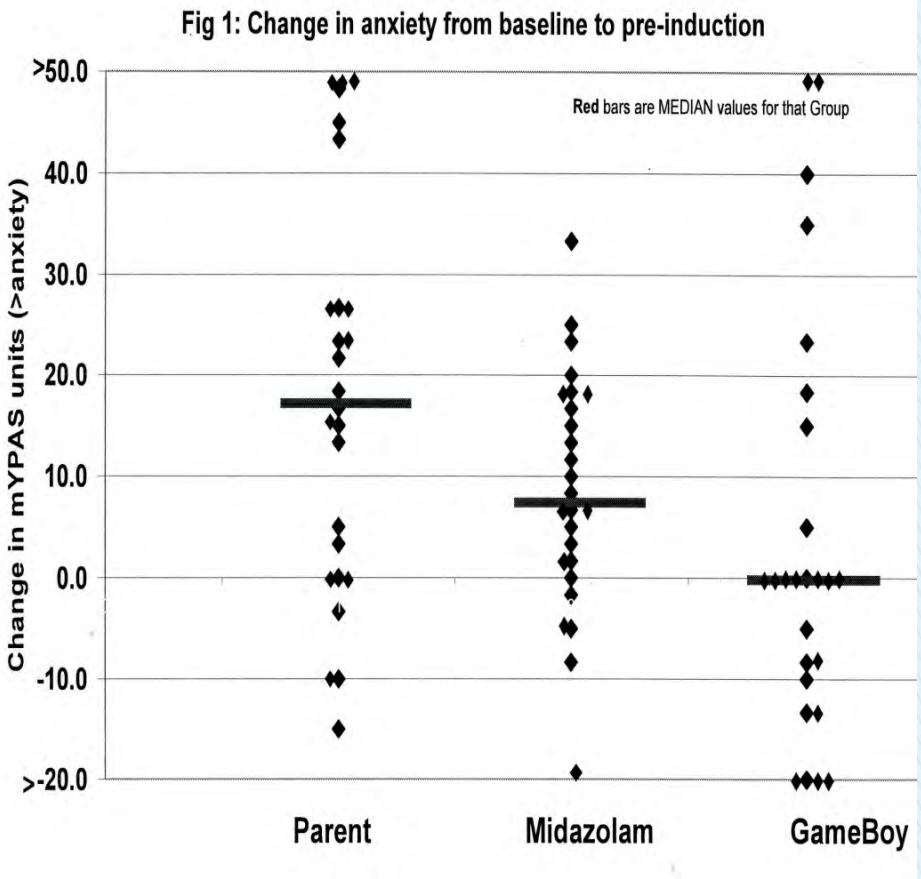
Evidence-based clinical update: does premedication with oral midazolam lead to improved behavioural outcomes in children?

- literature search for RCT with preoperative midazolam (M) with control arm (30)
- M reduced anxiety at separation and induction (grade A) w/minimal effect recovery
- inconsistent effect on PACU agitation
- inconsistent effect on behavioral outcomes at home (some have had *increased* Δ's)

Cox. *Can J Anaesth;* 2006 53:1213

Midazolam vs. Game-Boy ™



- prospective RCT
- 78 children 4-12 yrs

Tran. SPA winter meeting 2005

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Parental presence at induction (PPIA)

- "parents as partners" philosophy at HCH
- avoid separation (allows ↓ use premed)
- will increase parental satisfaction ALTHOUGH
- may increase parental anxiety with measurable changes in HR, cortisol (Kain)
- evidence-based review → PPIA is a poor anxiety reducer for either parent or child *

* Chundamala. *Can J Anaesth* 56:57;2009

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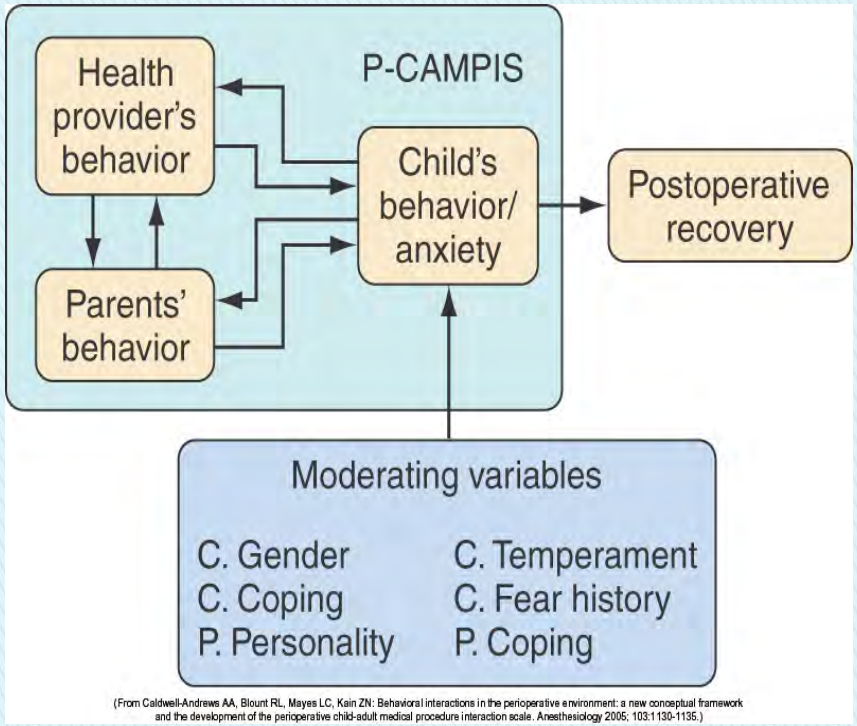
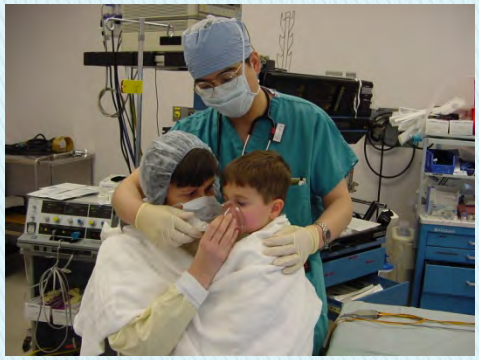
PPIA works best with a calm and well-prepared parent



Caldwell-Andrews. *Anesthesiology* 2005;103:1130

- emotion-based behaviors tend to decrease coping
- distraction-based behaviors tend to increase coping
- parents will take cues



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Inhalation induction: overview

- most common induction US < 10
- familiar with long history safe use
- non-pungent agents (hal/sevo) preferred
- agents have evolved but not basic technique
  - induce in mother's arms *
  - gentle voice *
  - essence of bitter orange to mask odor *

* Gwathmey *Anaesthesia* (1914)

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Inhalation induction: technique

- high-flow; N_2O will hasten induction
- sevo can be ↑ quickly (± nitrous "pre-med")
- mask or cupped hand if fearful of mask
- distraction / medical reinterpretation
- don't dawdle / bargain / apologize
- early CPAP may be advantageous
- avoid stimulation in light plane

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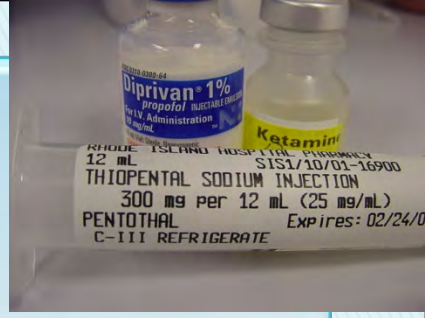
Inhalation induction: turbulence (i)

- struggling, uncooperative
  - 8% sevoflurane ("Brutane")
  - adapt to IV (butterfly) induction or IM
  - regroup, premedicate
- airway obstruction (vs. breathholding)
  - open airway non-invasive → invasive
  - hold CPAP / switch to 100% oxygen
  - IM sux or IV anesthetic

Inhalation induction: turbulence (ii)

- bradycardia / hypotension
  - IM/IV atropine (± glossal)
- arrhythmias (very common with halothane)
  - tachy ass'd with sevo → agitation (EEG Δ's)
  - ↓ sevoflurane to < 5 vol %, monitor
- emesis / aspiration
- difficulty with IV insertion
  - LMA option to secure airway, free hands
  - IO or surgical access if becomes urgent

Intravenous induction



- indwelling *sure* IV catheter
- special circumstances that preclude inhalation
- patient preference
- pain of IV insertion: EMLA vs. N_2O
- drug of choice usually propofol
  - injection pain troublesome; N_2O may work best

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Intravenous induction agents

DRUG	DOSE
thiopental	5–8 mg/kg
methohexital	1–2.5 mg/kg
propofol	2.5–3.5 mg/kg
ketamine	1–2 mg/kg
etomidate	0.2–0.3 mg/kg

Caveat emptor

- in a holding unit study at Rainbow Babies, 35% of inpatient IV's had significant issues that rendered them useless or sub-optimal
- 50% likely if infants
- 75% likely if > 72 hours

Tripi et al SPA winter meeting 2006

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The induction debate

Inhalation

- fear of needles
- pain of needle/drug
- dexterity not an issue
- reversible/incremental
- can be done in a lap
- ↑ safety sevoflurane
- child can participate

Intravenous

- fear of mask
- unpleasant scent
- availability EMLA™ etc
- post-sevo agitation
- IV available if issues

Special topic: intubation without muscle relaxants (IWMR)

- risks: laryngospasm, trauma, hemodynamic ↓
- SPA survey: 38% infants / 44% older children
  - ↑ non-academic setting / working alone
- Simon (*Ped Anaesthesia* 2002) – questionnaire
  - sevoflurane utilized more than propofol
  - ~ 5 vol % is optimal dose (± N_2O)
  - opioids as adjunct in slightly more than half
  - 87% success rate overall
  - ↑ desaturation < 1 year (15.9% vs. 1.7%)

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Induction: special circumstances *

- full stomach / aspiration risk
- anticipated difficult airway
- malignant hyperthermia susceptible
- congenital heart disease
- increased intracranial pressure
- trauma / hypovolemia

* not all inductions are the same, and special circumstances bring individual considerations

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