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Pediatric anesthesia update

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Pediatric anesthesia update

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OVERVIEW

•Improving safety in pediatric anesthesia
- POCA
- Pediatric care environment
- Evolving patterns

• Preparatory issues
- Respiratory problems: OSA, RAD, UTI, ETS
- Parental presence versus sedatives at induction
- Awareness and general anesthesia

• Intraoperative management
- Tracheal intubation
- Newer drugs in pediatric practice
- Regional techniques and ultrasound

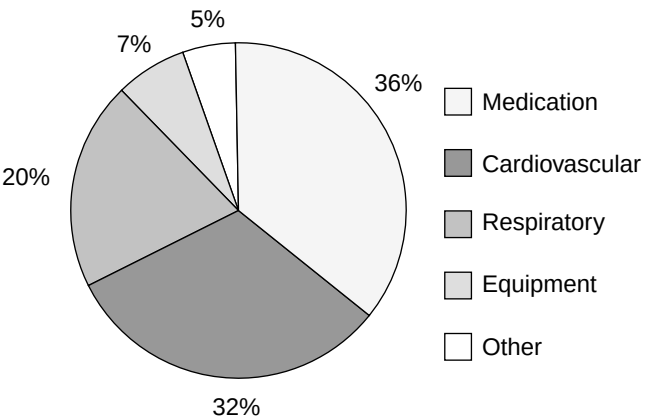
• Postoperative considerations
- Emergence delirium
- Nausea and vomiting

POCA: PEDIATRIC PERIOPERATIVE CARDIAC ARREST REGISTRY

- 289 cardiac arrests in registry
- 150 (52%) related to anesthesia
- Incidence of 1.4 in 10,000 anesthetics
- 55% in infants <1 year of age
- 33% occurred in ASA PS 1-2 patients

Morray JP et al. Anesthesiology 2000;93:6

PEDIATRIC CARDIAC ARREST MECHANISMS



THE SAFETY OF REGIONAL ANESTHESIA AND ANALGESIA IN CHILDREN

- 85,412 pediatric procedures in France
- 15,013 caudal blocks and 9,396 peripheral blocks
- Most common complications
  - dural penetration
  - intravascular injection
- Morbidity incidences
  - 0.7/1000 caudal
  - 0.0/1000 peripheral
  - 0.9/1000 overall

Giaufre E et al. Anesth Analg 1996;83:904

AMERICAN ACADEMY OF PEDIATRICS SECTION ON ANESTHESIOLOGY

- Evaluation and preparation of pediatric patients undergoing anesthesia

  Means LM. Pediatrics 1996;98:502

- Guidelines for the pediatric perioperative anesthesia environment

  Hackel A. Pediatrics 1999;103:512

PEDIATRIC PERIOPERATIVE ENVIRONMENT

- Risk of anesthesia varies with age
- Facilities, equipment, staff training appropriate for infants and children
- Minimum case volumes to maintain clinical competence
- Special clinical privileges: pediatric anesthesia fellowship or equivalent

CHOP AMBULATORY SURGERY CRITERIA

- ASA PS 1-3; well-controlled IDDM & SSDz allowed for short, non-airway procedures
- Age: > 1 mo for FT infants, > 60 wk PCA for former prematures, > 3 years for T&A
- No apnea monitoring, no severe OSA
- Approved surgical procedure
- Oral postoperative analgesics sufficient

AMBULATORY SURGERY FACILITY CRITERIA

- ASA PS 1-2
- Age > 6 mo, > 4 yr for T&A
- BMI = Wt (kg)/BSA (m^2) < 50; Wt < 100 kg
- Normal airway, no significant OSA
- Short, well-defined procedures
- Oral postoperative analgesics sufficient

CARDIAC ARREST AFTER SUCCINYLCHOLINE

	Patients (n)	Mortality (%)
Receptor upregulation		
Thermal trauma, muscle trauma, denervation, ICU milieu, Misc.	64	11
Rhabdomyolysis		
Duchene, Becker, Myopathy, Unknown diagnosis	57	30

Gronert GA. Anesth 2001;94:523

RAPACURONIUM AND BRONCHOSPASM: A RETROSPECTIVE COHORT STUDY

	Bronchospasm n = 12	None n = 275	RR (95% CI)
ASA III-IV (%)	6 (50)	81 (30)	2.2 (0.8-6.9)
RAD Hx (%)	7 (53)	59 (22)	4.6 (1.5-14.3)
RSI (%)	11 (92)	106 (39)	17.5 (2.9-inf)

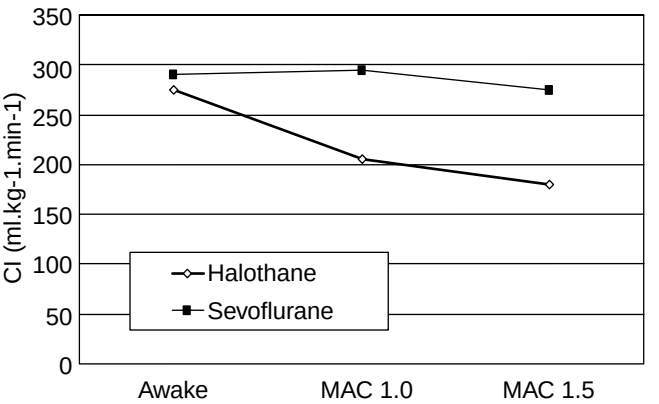
Rajchert D, et al. Anesth Analg 2002;94:488

RAPACURONIUM AND BRONCHOSPASM: A CASE CONTROL STUDY

	Cases n = 23	Controls n = 92	OR (95% CI)
RAD (%)	11 (48)	20 (22)	3.3 (1.3-8.5)
Rapacuronium (%)	12 (52)	9 (10)	10.1 (3.5-28.8)

Rajchert D, et al. Anesth Analg 2002;94:488

CARDIAC INDEX IN INFANTS: SEVOFLURANE *VERSUS* HALOTHANE



Wodey E. Anesthesiology 1997;87:795

SEVOFLURANE OVER HALOTHANE

- Decreased OCR incidence during strabismus surgery in children
  - Allison CE. Anesth Analg 2000;90:306
- Duration of preop fast correlates with ABP response to halothane in infants
  - Friesen RH. Anesth Analg 2002;95:1572
- Preservation of CI, HR, and less profound decreases in BP in infants/children with CHD
  - Rivenes SM. Anesth 2001;94:223
  - Russell IA. Anesth Analg 2001;92:1152

RESPIRATORY ISSUES IN PEDIATRICS

- Obstructive sleep apnea
- Reactive airway disease
- Upper respiratory tract infection
- Secondhand tobacco smoke

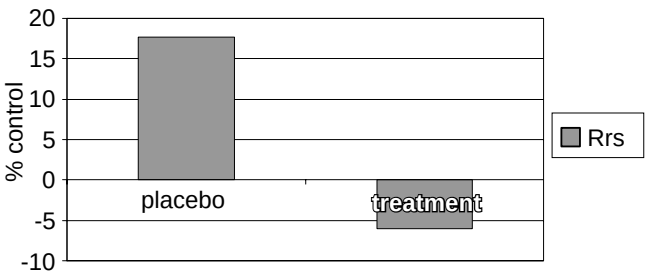
DECREASED VENTILATORY RESPONSE TO CO_2 IN CHILDREN WITH OBSTRUCTIVE SLEEP APNEA

	T&A + OSA	T&A + OSA	Non AW - OSA
Slope: mL *min-1 *mmHgETCO2-1	558	607	747
Corrected slope: slope*m-2	538 ± 338†	828 ± 234	850 ± 380

†p < 0.05 for OSA *vs* none

Strauss SG. Anesth Analg 1999;89:328

SALBUTAMOL PREVENTS THE INCREASE OF RESPIRATORY RESISTANCE CAUSED BY TRACHEAL INTUBATION DURING SEVOFLURANE ANESTHESIA IN ASTHMATIC CHILDREN



Scalfaro P. Anesth Analg 2001;93:898

LARYNGOSPASM AND THE URI

Risk variable	OR	95% CI	P value
Parent: active URI	2.05	1.21-3.45	0.01
Age (continuous variable)	0.92	0.87-0.99	0.02
Procedure: Airway *vs* non	2.08	1.21-3.59	0.01
Midazolam *vs* none	0.57	0.32-1.05	0.07
Inexperienced *vs* experienced supervisor	1.69	1.04-2.7	0.03

Schreiner MS. Anesthesiology 1996;85:475

TOBACCO SMOKE AND ADVERSE RESPIRATORY EVENTS IN CHILDREN

Urinary cotinine (mg/ml)	Severe cough in OR	Sp O_2 < 95% in OR	Breath holding	Severe cough in RR	Laryngo-spasm
0.0-9.9	1.0	1.0	1.0	1.0	1.0
10.0-39.9	1.8 (0.9-3.5)	1.1 (0.5-2.6)	1.7 (0.4-6.7)	1.8 (0.7-4.6)	0.7 (0.2-2.4)
> 40.0	2.3 (1.0-5.5)	2.6 (1.1-6.2)	5.1 (1.2-22.4)	2.3 (0.7-7.7)	2.3 (0.8-7.3)
Linear trend test (p)	0.03	0.07	0.04	0.10	0.31

Skolnick ET. Anesthesiology 1998;88:1144

PARENTAL ANXIETY AT INDUCTION

Subgroup	N	Parent VAS reception	Induction
Calm-treatment	30	12.2 ± 11.0	31.2 ± 33.5
Calm-control	33	19.2 ± 13.3	42.1 ± 35.1
Anxious-treatment	24	78.8 ± 16.6	81.7 ± 18.7
Anxious-control	25	72.5 ± 18.0	65.6 ± 29.3

Bevan JC. Can J Anaesth 1990;37:177

PARENTAL ANXIETY AT INDUCTION: CHILDREN'S MOOD RESPONSE

Subgroup	N	Child Õs GMS reception	Induction
Calm-treatment	30	1.7 ± 0.9	3.4 ± 1.6
Calm-control	33	2.1 ± 1.4	3.5 ± 1.8
Anxious-treatment	24	1.7 ± 1.2	4.5 ± 1.5*
Anxious-control	25	1.6 ± 0.8	3.4 ± 1.5

** p < 0.05 A-T vs A-C at induction*

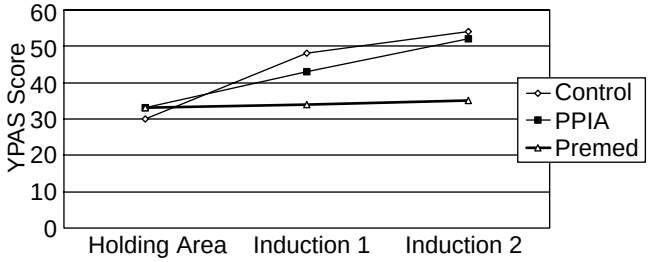
Bevan JC. Can J Anaesth 1990;37:177

PPIA: ELEMENTS THAT UPSET PARENTS

1) Separation from the child
2) Watching or feeling the child go limp
3) Seeing the child upset

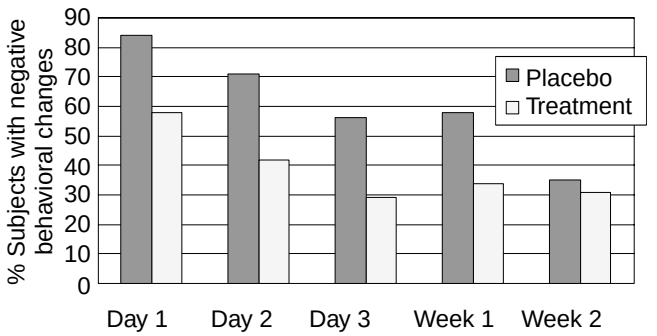
Vessey JA. Can J Anaesth 1994;41:276

PEDIATRIC PERIOPERATIVE ANXIETY: PPIA *VS* SEDATIVE PREMEDICATION



Kain ZN. Anesthesiology 1998;89:1147

SEDATIVE PREMEDICATION AND BEHAVIOR



Kain ZN. Anesthesiology 1999;90:758

TRACHEAL INTUBATION WITHOUT MUSCLE RELAXANT IN PEDIATRIC ANESTHESIA

- Rationale
  - Muscle relaxant not needed for intubation or surgery
  - NDMRs last too long, prefer to avoid succinylcholine
  - Lack assistant to start IV, difficult venous access
  - Educational tool

Politis GD. Anesth Analg 1999;88:737

- Timing
  - 140-190 sec under 8% sevoflurane
  - Ablation of SV associated with better conditions

Politis GD. Anesth Analg 2002;95:615

CUFFED *VERSUS* UNCUFFED TRACHEAL TUBES IN PEDIATRIC ANESTHESIA

	Cuffed N = 251	Uncuffed N = 237	P value
Age (yr)	3.3 ± 2.4	2.9 ± 2.2	NS
Weight (kg)	15.4 ± 7.4	14.3 ± 7.7	NS
Intubation duration (min)	55	60	NS
Pts needing TT change	3 (1.2%)	54 (23%)	< 0.001
Pts needing > 2 lpm FGF	3 (1.2%)	26 (11%)	< 0.001
Pts with croup sx	6 (2.4%)	7 (1.3)	NS
Treated	3 (1.2%)	3 (1.3%)	NS
Admitted	1 (0.4%)	1 (0.4%)	NS

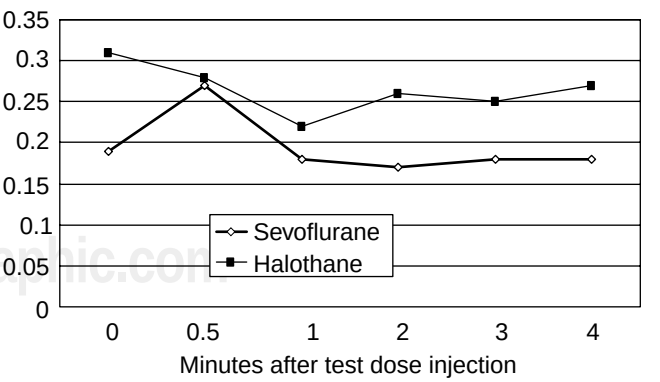
Khine HH. Anesthesiology 1997;86:627

REMIFENTANYL COMPARED TO ALFENTANYL, ISOFLURANE, OR PROPOFOL FOR PEDIATRIC STRABISMUS SURGERY

- No difference in times to tracheal extubation, purposeful movement, PACU or hospital DC
- Remifentanil group: higher PACU pain scores
- Alfentanil group had greater incidences of decreased SpO2 and need for naloxone
- No difference in incidences of emesis
- Hemodynamic profiles similar

Davis PJ. Anesth Analg 1997;84:982

EPINEPHRINE TEST DOSING IN CHILDREN DURING SEVOFLURANE VERSUS HALOTHANE ANESTHESIA



Kozek-Langenecker SA. Anesth Analg 2000;90:579

ROPIVACAINE IN PEDIATRIC CAUDAL BLOCKS

	Bupivacaine 0.25%	Ropivacaine 0.25%	Ropivacaine 0.5%
N	17	18	21
Analgesia duration med.& range (min)	220 (100-390)	208 (175-340)	1,440 (335-1,440)*
Stand (min)	253 ± 39	248 ± 30	362 ± 42*
Void (min)	248 ± 75	243 ± 30	291 ± 75***

* p < 0.0001 R0.5 *vs* other groups; ***p < 0.05 R0.5 *vs* other groups

Koining H. Anesthesiology 1999;90:1339

PEDIATRIC EPIDURAL ADJUVANTS

- Ketamine
  - Koinig H. Anesth 2000;93:976
- Clonidine
  - De Negri P. Anesth Analg 2001;93:71
  - Hager H. Anesth Analg 2002;94:1169
  - Fellmann C. Paed Anaesth 2002;12:637
- Neostigmine
  - Abdulatif M. Anesth Analg 2002;95:1215

DELIRIUM AFTER SEVOFLURANE ANESTHESIA

	Preschool		School	
Variable	Halo	Sevo	Halo	Sevo
N	30	30	26	26
Age (yr)	3 ± 1	3 ± 1	8 ± 1	9 ± 1
Wt (kg)	18.9 ± 3.4	18.6 ± 3.3	29.5 ± 3.7	28.3 ± 2.8
Surg (min)	29 ± 4	28 ± 8	41 ± 6	43 ± 6
Ext (min)	13 ± 3	8 ± 2*	12 ± 2	8 ± 3*
Emg (min)	15 ± 3	12 ± 3	15 ± 4	12 ± 4
Delirium Incidence	3/30 (10%)	12/30 (40%)***	4/26 (15.4%)	3/26 (11.5%)

* p < 0.0001, p < 0.01, p < 0.05, ***p < 0.01, 0.03

Aono J. Anesthesiology 1997;87:1298

RECOVERY CHARACTERISTICS: HALOTHANE *VERSUS* SEVOFLURANE

	Agitation	PACU pain med	PACU emesis	24 hr emesis	Home pain med
Group					
H/K	12*	14*	2	10	48
H/P	42	48	14	17	61
S/K	14***	22***	6	12	65
S/P	38	46	6	11	61

Values in %; * p < 0.05 *vs* H/P group; ***p < 0.05 *vs* S/P group

Davis PJ. Anesth Analg 1999;88:34

NASAL FENTANYL & RECOVERY CHARACTERISTICS AFTER BILATERAL MYRINGOTOMY/TUBE PLACEMENT

Group	CHEOPS max	Agitation max	Agitation score of 4	PACU VAS	Emesis hospital	Emesis home
S/P	8.6 ± 1.8	2.7 ± 1.0	16/69 (23%)	53 ± 36	13%	34/135 (25%)
S/F	7.2 ± 1.6*	1.8 ± 0.9*	1/64 (2%)*	82 ± 25*	18%	
H/P	8.4 ± 2.0	2.3 ± 1.0	7/63 (11%)	62 ± 37	19%	65/130 (50%)***
H/F	6.8 ± 1.7*	1.5 ± 0.9*	1/67 (1%)*	85 ± 25*	26%	

* p < 0.05 when compared to both placebo groups, ***p < 0.05 H vs S

Galinkin JL. SPA Abstract 2000

SYSTEMIC POSTOPERATIVE ANALGESIA

- Acetaminophen (20-40 mg/kg PR)
  - Birmingham PK. Anesthesiology 1997;87:244
- Ketorolac (0.5-1.0 mg/kg IV)
  - Romsing J. Anaesthesia 1997;52:673
- Morphine sulfate (0.05-0.1 mg/kg IV)
  - Weinstein MS. Anesthesiology 1994;81:572
- Oxycodone (0.05-0.15 mg/kg PO)
- Tramadol (50 mg tablets, unscored)

SINGLE-DOSE ONDANSETRON FOR PEDIATRIC AMBULATORY SURGERY: PREVENTION OF POSTOPERATIVE EMETIC EPISODES

	Placebo	Ondansetron
0-2 h	153/215 (71%)	190/213 (89)*
0-24 h	86/215 (40%)	143/210 (68)*

* p < 0.001 ondansetron vs placebo

Patel RI. Anesth Analg 1997;85:538

ONDANSETRON ± DEXAMETHASONE: EFFECT ON VOMITING AFTER STRABISMUS SURGERY

Emetic episode location	Ondansetron 50 mg/kg + dexamethasone 150 mg/kg	Ondansetron 150 mg/kg	P value
In-hospital	1%	7%	< 0.05
At home day of surgery	7%	14%	NS
Next day	5%	15%	< 0.05
Overall	9%	28%	< 0.001

Splinter WM. Anesthesiology 1998;88:72