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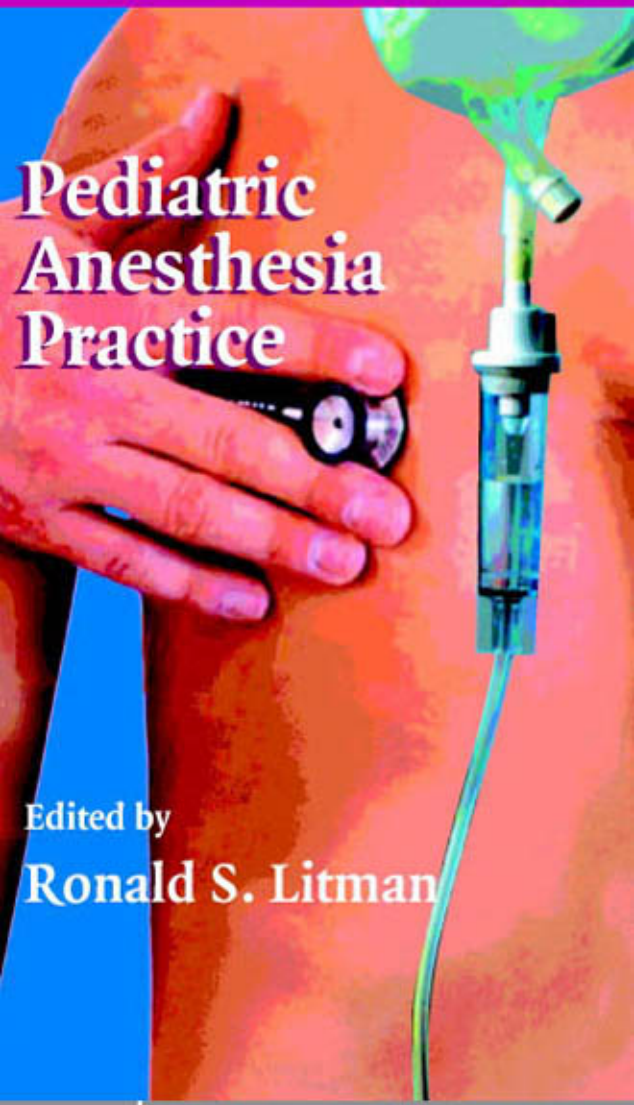

Pediatric Anesthesia Practice

Edited by

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Preface

The care of children in the perianesthetic period requires a unique knowledge base and skill set that differs widely from that required for the anesthetic care of the adult patient. The physiology of organ systems is developing throughout childhood, and thus, anesthetic pharmacology differs correspondingly. Infancy and childhood are associated with a myriad of medical problems that often carry into adolescence and adulthood. For these reasons, anesthesiology residents and anesthesia practitioners who are not experts in pediatric anesthesia require a complete and accurate guide to providing care that is consistent with the standards implemented at the leading children's hospitals. *Pediatric Anesthesia Practice* aims to provide such a point-of-care guide, utilizing contributions by 61 authors from institutions throughout the world, and edited in a uniform style.

This text is organized into three main sections: Surgical Procedures, Coexisting Diseases, and Regional Anesthesia. The Surgical Procedures section contains details on the anesthetic management of more than 100 common pediatric surgical procedures. Each is divided into six separate important sections that cover the entire perioperative period. These include the common coexisting diseases associated with that particular procedure, preoperative assessment strategies, procedural considerations, anesthetic plan recommendations, pain management strategies, and postoperative considerations.

The section on Coexisting Diseases contains chapters encompassing the most common and most important pediatric diseases with anesthetic implications. Each chapter is divided into four main sections that include information on the aspects of that

particular disease, preoperative assessment of patients with that disease, intraoperative management of those patients, and postoperative considerations.

The section on Regional Anesthesia contains chapters with details on the most commonly performed pediatric regional anesthesia techniques. Each chapter contains four separate subsections on indications for the technique, pre-procedural assessment of the patient, procedural management of the technique, and postoperative considerations of the technique.

Pediatric Anesthesia Practice is, I believe, an indispensable resource for a variety of different anesthesia practitioners that provide anesthesia care to children.

Ronald S. Litman

PART ONE

Coexisting Diseases

ANTERIOR MEDIASTINAL MASS

PAUL STRICKER, MD

BACKGROUND

- Most common cause: lymphoma
- Suspect in pts presenting for cervical mass biopsy.
- Other dxs: neuroblastoma, teratoma, germ cell tumor, bronchogenic cyst, foregut cyst, lymphangioma, mesenchymal tumor
- Symptoms due to compression of anatomic structures
- Symptoms worse when supine
- Symptoms may be relieved by lateral or upright position.
- Clinical: cough, hoarseness, dyspnea, wheezing, orthopnea, stridor, chest pain, syncope, SVC syndrome, tracheal deviation, retractions
- Asymptomatic or nonspecific: fever, fatigue, weight loss

PREOPERATIVE ASSESSMENT

- Preoperative radiation tx may interfere with accurate histologic dx & optimal tx regimens.
- Physical exam: orthopnea, tracheal deviation, jugular venous distention, wheezing, retractions, unilateral decreased breath sounds
- CXR: tracheal deviation, tracheal compression, abnormal cardiothymic silhouette
- Echo: direct compression of cardiac chambers and/or great vessels, pericardial effusion
- CT: assess severity & location of tracheal compression
- Preop sedation: avoid or give in monitored setting
- Antisialagogue (e.g., glycopyrrolate) useful

- Obtain IV access prior to OR, ideally in lower extremity.
- Correct preexisting dehydration or hypovolemia.

INTRAOPERATIVE MANAGEMENT

- Potential catastrophic airway or cardiovascular collapse during induction of anesthesia
- Monitors: std; A-line for great vessel or cardiac compression
- All sized endotracheal tubes and rigid bronch immed avail in OR
- For severe cases, ECMO or CPB stand-by
- Liberal fluid administration if great vessel/cardiac compression
- Position: semi-recumbent, sitting, or lateral
- Local anesthesia without sedation is safest strategy, but not feasible for small children.
- Most important to avoid airway/CV collapse: MAINTAIN SPONTANEOUS VENTILATION
- Mask or LMA OK
- Ketamine allows spontaneous ventilation & provides sympathetic stimulation.
- Sevoflurane or IV agents OK if titrated to avoid apnea
- Paralysis & controlled ventilation OK for mild cases, but no way to predict safety
- Tx of airway obstruction: positive pressure, change position to lateral, sitting or prone if CV arrest
- Rigid bronch may bypass airway obstruction.
- ECMO or CPB as lifesaving measure

POSTOPERATIVE CONCERNS

- Airway obstruction may occur postop during recovery.
- Recover in lateral or semi-recumbent position.
- Titrate opioids: avoid apnea.

ASTHMA

SANJAY M. BHANANKER, MD, FRCA

BACKGROUND

- Incidence: 7–19%
- Cause: chronic inflammation & mucus hypersecretion of lower airways
- Symptoms: airway hyperreactivity with variable degrees of airflow obstruction
- Strong association with atopy and allergy

PREOPERATIVE ASSESSMENT

- Note severity and frequency of acute exacerbations, precipitating factors.
- Elicit history of drug therapy, especially systemic steroids, to gauge severity.
- If acute exacerbation or URI within 6 wks, consider postponing elective surgery.
- Premed: inhaled beta-2 agonist, steroids (daily meds)
- Anxiolysis with oral midazolam; fear, stress, excitement, or hyperventilation can provoke acute attack

INTRAOPERATIVE MANAGEMENT

- Mask induction with sevoflurane or IV induction with propofol or ketamine
- Minimize airway manipulation.
- Face mask or LMA preferred
- Avoid histamine-releasing drugs: thiopental, morphine, mivacurium, succinylcholine.
- All volatile anesthetic drugs, propofol and ketamine are bronchodilators.
- Administer stress dose of IV hydrocortisone if pt on oral prednisone.

- If intraoperative wheezing occurs:
  i. Rule out kinked ET tube or bronchial intubation
  ii. Give 100% oxygen, deepen anesthesia with propofol, ketamine, or volatile agents
  iii. IV lidocaine 0.5–1 mg/kg bolus
  iv. Use low respiratory rate and long expiratory time to avoid intrinsic PEEP
  v. Nebulized beta-2 agonist such as albuterol via ET tube or LMA

POSTOPERATIVE CONCERNS

- Deep extubation for pts with uncomplicated airway avoids risk of bronchospasm during emergence.
- If awake extubation planned, nebulized prophylactic beta-2 agonist, IV lidocaine
- Humidify supplemental oxygen, ensure adequate systemic hydration: dry anesthetic gases and O_2 are potential triggers for asthma.

ATRIAL SEPTAL DEFECT (ASD)

LUIS M. ZABALA, MD

DISEASE CHARACTERISTICS

- Definition: opening in the atrial septum except patent foramen ovale (PFO)
- 7–10% of all CHD
- Incidence of PFO in adults: 25%
- Pathophys: extra load on right side of the heart (L to R shunt)
- Magnitude of shunt relates to size of defect, ventricular compliance, & pulmonary artery pressures.
- L to R shunt: RA & RV enlargement
- Pulmonary vascular changes develop from long-standing volume overload.

6 Atrial Septal Defect (ASD)

- Majority of pts are asymptomatic during childhood.
- In adulthood, extra load on RV leads to CHF, failure to thrive, recurrent respiratory infections, & symptomatic supraventricular dysrhythmias.
- Pulm htn in up to 13% of nonoperated pts

PREOPERATIVE ASSESSMENT

- CXR: RA & RV enlargement.
- ECG: right or left axis deviation possible; incomplete RBBB from stretch in right bundle of His
- Echo: secundum or primum defect; mitral regurg from anterior leaflet cleft.
- Ventricular dysfunction possible from long-standing volume overload
- Cardiology consultation for symptomatic pts
- Premed: PO midazolam (0.5 mg/kg) or PO pentobarbital (4 mg/kg)
- Caution with oversedation & hypoventilation: can worsen PVR & RV fn

INTRAOPERATIVE MANAGEMENT

- Std monitors during noncardiac surgery or transcatheter closure of ASD
- Symptomatic or complicated pts may require additional monitoring.
- Intracardiac surgical repair requires extracorporeal circulation and arterial invasive monitoring.
- Central venous monitoring at discretion of anesthesiologist
- Transesophageal echo helpful to assess de-airing of left heart & adequacy of surgical repair
- Inhalation induction generally safe
- Inhalation agents, narcotics, muscle relaxants, and/or regional anesthesia usually well tolerated
- De-bubble all IV lines.
- Atrial dysrhythmias common in adult unrepaired pt

POSTOPERATIVE CONCERNS

- Immediate or early tracheal extubation possible following uncomplicated surgical repair of ASD
- Pts with good ventricular function prior to repair do not require inotropic support.
- Dopamine 3–5 mcg/kg/min usually sufficient for ventricular dysfunction
- Pulm htn may occur in older pts after ASD repair; use aggressive ventilation & milrinone.
- Pts with unrepaired ASD undergoing noncardiac surgery should be monitored closely for CHF due to volume overload or atrial dysrhythmias.
- Titrate analgesia to pain control without vent depression.

CEREBRAL PALSY

NATHALIA JIMENEZ, MD, MPH

BACKGROUND

- Definition: static motor encephalopathy
- Secondary to perinatal or early childhood (<2 yr) CNS injury
- Incidence 2.4 per 1,000 live births
- 4 categories: spastic (quadriplegia, diplegia, hemiplegia), dyskinetic (dystonia, athetosis, chorea), ataxic (tremor, loss of balance, speech involvement), mixed
- Assoc with developmental delay, visual & cognitive abnormalities, & motor problems possible with normal cognitive function
- Require multiple surgeries: mainly orthopedic (spinal fusion and release of limb contractures)
- Bulbar motor dysfunction predisposes to GE reflux, swallowing disorders & loss of airway protective mechanisms leading to chronic aspiration, recurrent pneumonia, hyperactive airways

- Seizures in 30%: continue anticonvulsant on day of surgery & reinstitute early in postop period
- Baclofen used for muscle spasms, can cause urinary retention & leg weakness
- Abrupt baclofen withdrawal may cause seizures; overdose assoc with decreased consciousness & hypotension

PREOPERATIVE ASSESSMENT

- Premedication tolerated in most pts; reduce dose or avoid if hypotonic
- Anticholinergic will decrease secretions in pts with bulbar dysfunction.

INTRAOPERATIVE MANAGEMENT

- Contractures make positioning and IV access difficult.
- Impaired temp regulation due to hypothalamic dysfunction
- Monitor temperature and use warming measures.
- Inhalation induction safe unless severe reflux
- Increased sensitivity of succinylcholine: use only in emergency situations
- Decreased sensitivity to non-depolarizing muscle relaxants: requires higher doses
- Increased sensitivity to inhaled anesthetics and opioids: use lower doses
- Awake extubation in OR

POSTOPERATIVE CONCERNS

- Pain assessment difficult due to inability to communicate: use modified behavioral pain scales
- Regional techniques for postop analgesia recommended
- Low-dose benzodiazepines (diazepam) to prevent/treat muscle spasms

COARCTATION OF THE AORTA

SCOTT D. MARKOWITZ, MD

BACKGROUND

- Prevalence: 8% of pts with CHD
- Coexisting bicuspid aortic valve, arch hypoplasia, other heart defects
- Hypertension is usually present pre-repair and may persist postop.
- May be repaired with balloon dilation or surgical correction end-to-end anastomosis or subclavian flap arterioplasty
- Residual or recurrent coarct may occur early or late: eval by right arm vs. leg BP & Doppler echo.

PREOPERATIVE ASSESSMENT

- ECG & echo: ventricular hypertrophy/dysfunction, valve dysfunction, residual coarct
- BP measurements in all extremities, identification of previous recurrent laryngeal nerve injury
- Antihypertensive regimen assessed and instructions for day of surgery medication administration given

INTRAOPERATIVE MANAGEMENT

- SBE prophylaxis even after repair
- If pre-repair: BP monitoring on pre-coarct artery (usually right arm except in cases of aberrant subclavian artery)
- If post-repair: monitors accurate in any extremity, except if residual coarct
- Left arm BP unreliable after subclavian flap repair
- Caution with intercostal blocks if intercostal arteries dilated

POSTOPERATIVE CONSIDERATIONS

- Std pain management: opioids & NSAIDs
- Monitor for arrhythmias; resume antihypertensive therapy as appropriate.

CRANIOFACIAL SYNDROMES

SALLY E. RAMPERSAD, MB FRCA

BACKGROUND

- Premature fusion of one or more skull sutures
- Major component of several congenital syndromes: Crouzon, Saethe-Chotzen, Pfeiffer, Carpenter, Aperts

PREOPERATIVE ASSESSMENT

- Previous anesthetic records: airway issues & management
- Examine for obstructing mass (cystic hygroma, large tongue in Beckwith-Wiedemann syndrome; micrognathia/retrognathia in Pierre Robin); limited mouth opening, limited neck mobility, facial asymmetry (Goldenhars).
- Abnl ear form & position indicate other facial anomalies.
- Inform family of potential airway complications.
- Snoring, daytime somnolence, or hx of stridor may indicate significant airway obstruction.
- Cleft lip/palate are part of other syndromes (eg, CHARGE, trisomy 18, velocardiofacial syndrome).
- Associated anomalies: ear, renal, CV
- Avoid pre-op sedation in pts with potential airway obstruction, or administer with anesthesiologist present.
- PO or IV atropine (0.02 mg/kg) as antisialagogue/vagolytic
- Prepare different sizes of facemasks (air-filled cushion for asymmetric face), LMAs, oral & naso-pharyngeal airways, endotracheal tubes, fiberoptic bronchoscopes, stylets.