Anesthetic Management for Craniosynostosis Repair: "Unlocking the Brain"

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Objectives

• Provide historical and descriptive overview
• Discuss surgical management and options
• Discuss anesthesia care, concerns, and controversies
Pericles

“The Squill-Headed One”
Epidemiology
Incidence 1:2000

• NON-SYNDROMIC
  • Sagittal (40-50%)
  • Coronal (20-30%)
  • Metopic (5-10%)
  • Lambdoid (5%)

• SYNDROMIC
Pathogenesis

- Failure of normal interplay between developing brain, cranial bone, and dura
- Mutations of genetic regulation, fibroblast growth factor receptors, and transcription factors:
  - FGF-R1, -R2, -R3
  - TGF -1,-2,-3
  - TWIST1
Pathogenesis

- Decreased bone growth adjacent to fused suture
- Increased, asymmetric bone deposition at the perimeter and at distance
Clinical Craniofacial Manifestations

- Appearance
- Hydrocephaly & increased intracranial pressure (15% in single suture, 50% in syndromic)
- Developmental delay?
- Strabismus/visual changes/head tilt/proptosis
- Upper airway obstruction

Collmann et al., Childs Nerv Syst 21:902, 2005
Surgical Options

• Strip craniectomy

• Pi-procedure-Modified Pi

• Cranial Vault Surgery

• Endoscopic Assisted

• Dynamic: Internal/External Distractors

Advantages of “Non-invasive” Procedures

- ↓ Blood loss/Need for transfusion
- ↓ Complications
- ↓ ICU care
- ↓ Surgical/Anesthesia time
- Long term?

Spring-assisted:  Ririe et al, Pediatric Anesthesia 21:1015, 2011

Developmental Effects of Anesthesia/Surgery?

- Neuro-developmental follow-up of 89 infants undergoing single suture repair
- Duration of anesthesia-surgery (30 min increments) correlated inversely with mental & psychomotor scores

Naumann et al., Pediatric Anesthesia 22:1053, 2012
Anesthetic Concerns: Preoperative

• Airway
• Blood Product Preparation/Coagulation Studies?
• Cardiac Evaluation/Intervention?

Thomas K et al., Pediatric Anesthesia 22:1033, 2012
Hughes et al., Pediatric Anesthesia 23:22, 2013
Stricker et al., Pediatric Anesthesia 21:1026, 2011
Anesthetic Concerns:

Intraoperative #1

- Securing of airway
- Adequate vascular access and monitoring
- Proper positioning
- Blood products!
- Attention to ICP
- Attention to metabolic/physiologic changes
Anesthetic Concerns: Intraoperative #2

• Venous Air Embolism!! (83%)
  • Grade 1: Doppler changes (48%)
  • Grade 2: End-tidal $\text{CO}_2$ changes (36%)
  • Grade 3: Hypotension (16%)

Faberowski et al, Anesthesiology 92:20, 2000
Anesthetic Care: Postoperative

- Ventilatory support
- Analgesia
- Correction of anemia & coagulopathy
- Metabolic changes, esp. hyponatremia

Cladis et al., Pediatric Anesthesia 21:1020, 2011
Anesthetic Controversies

- Pre-emptive transfusion of blood products?
- Whole vs component blood therapy?
- Reducing homologous transfusion?

Cortellazzi et al., Pediatric Anesthesia 19:1251, 2009
Stricker et al., Pediatric Anesthesia, 20:150, 2010
Stricker et al., Pediatric Anesthesia 21:54, 2011
Anesthetic Controversies

- Blood donation/dilution/salvage (~20%)
- Controlled hypotension
- Local anesthesia
- EPO (< 20%)
- Activated Factor VII (24%)
- TXA (20-30%)

Dadure et al., Anesthesiology 114:856, 2011
Goobie et al., Anesthesiology 114:862, 2011
Pediatric Craniofacial Surgery Perioperative Registry (PCSPR)

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