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Anesthesia for the Child with Congenital Heart Disease (CHD) for Non-cardiac Surgery

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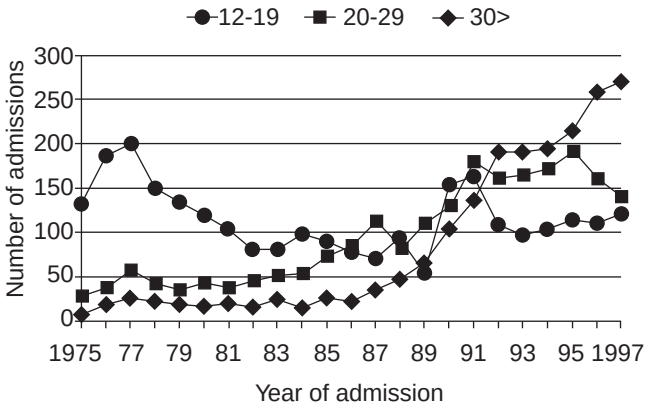
OBJECTIVES

- Demographics
- Determinants of physiologic function
- Surgical procedures
- Anesthetic management

HOSPITAL ADMISSION RATE - MAYO CLINIC



PREVALENCE OF CONGENITAL HEART MALFORMATIONS

Lesion	Infants (%)	Children (%)	Adults (%)
Ventricular septal defect	28.3	24	15
Patent ductus arteriosus	12.5	15	15.5
Atrial septal defect	9.7	12	16
Coarctation	8.8	4.5	8
Transposition of great art	8	4.5	2
Hyoplastic left heart synd	7.8	—	—
Tetralogy of Fallot	7	11	15.5
Pulmonary stenosis	6	11	15
Aortic stenosis	3.5	6.5	5
Truncus arteriosus	2.7	0.5	—
Tricuspid atresia	1	1.5	1

DETERMINANTS OF PHYSIOLOGIC FUNCTION

- Sequelae
- Complications
- Palliation
- Correction

DEMOGRAPHICS OF CHD IN USA

- 21,000-43,000 live births annually
- 20,000 cardiac surgical procedures
- Over 80% survival to third decade
- Prevalence 500,000-800,000
- Heterogeneous population

COMMON SEQUELAE

- Arrhythmia
- Ventricular dysfunction
- Hemodynamic disturbance
- Pulmonary vascular disease

DETERMINANTS OF PHYSIOLOGIC FUNCTION

- Sequelae
- Complications
  - CNS
  - Renal
  - Hematologic

DETERMINANTS OF PHYSIOLOGIC FUNCTION

- Sequelae
- Complications
- Palliation
  - e.g. single ventricle & Fontan

DETERMINANTS OF PHYSIOLOGIC FUNCTION

- Sequelae
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SURGERY IN CHILDREN WITH CHD

- Dental procedures
- General surgery
- Urology
- Trauma
- Orthopedic surgery

CHOP NON-CARDIAC SURGERY 2004

- Requests 945/CVA 424
- PS II (154), PS III (195), PS IV (75)
- Elective (400), emergency (24)
- Day Surgery (274), overnight stay (150)
- Simple procedures (60%) – BMT, T/A, circumcision, hernia
- Complex procedures (40%) – TEF, brain tumor, tumor resection, transplant, etc

SURGERY IN ADULTS WITH CHD

- Labor and delivery
- Trauma
- Orthopedic surgery
- General surgery
- Cardiac surgery

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DESIRABLE HEMODYNAMIC OBJECTIVES

	Preload	PVR	SVR	HR	Contractility
ASD (L→R)	↑	↑	↓	N	N
PDA (L→R)	↑	↑	↓	N	N
VSD (L→R)	↑	↑	↓	N	N
VSD (R→L)	N	↓	↑	N	N
AS	↑	N	↑*	↓*	N-↑
IHSS	↑	N	N-↑	↓*	↓*
Valvar PS	↑	↓	N	↓	↑
Infundibular PS	↑	↓	N	↓	↓*
Coarctation	↑	N	↓	N	N
MS	↑	N-↓	N	↓*	N-↑
MR	↑	N-↓	↓	N-↑	N-↑
AI	↑	N	↓	N-↑	N-↑

* overriding consideration

ANESTHETIC MANAGEMENT

- More important to be guided by a safe, familiar, established anesthetic technique than to have a detailed understanding of the specific pathophysiologic lesion

ANESTHETIC MANAGEMENT

- Patient evaluation
- Cardiologist communication
- Perioperative plan
  - Preoperative goals
  - Postoperative expectations
- Physiologic anesthetic

EVALUATION OF CARDIAC STATUS

- Activity tolerance
- Growth pattern
- Congestive heart failure
- Magnitude of cyanosis
- Medications
- Cardiologist evaluation

FORMULATION OF AN ANESTHETIC PLAN

- Patient considerations
- Operative considerations
- Postoperative considerations

PATIENT CONSIDERATIONS

- Associated conditions –e.g Chr 22
- Airway –e.g. tracheal stenosis
- Psychosocial issues –e.g. depression
- Medications
- Hematocrit –e.g. cyanosis

OPERATIVE CONSIDERATIONS

- SBE prophylaxis –e.g. AHA
- Monitoring –e.g. BP, ECG, Pulse Ox
- Vascular access –e.g. CVP, A-line
- Positive pressure ventilation –e.g. VR
- Laparoscopy
  - Insufflation, Trendelenberg
  - VR & PBF, emboli & R->L shunts
- Single lung ventilation
  - Cyanosis, PBF, AV malformations

POSTOPERATIVE CONSIDERATIONS

- PACU *vs* ICU
- Patient comfort
  - Pain – SVR & PVR changes, neuraxial analgesia
  - N&V – fluids
- Fluid management

CONCLUSIONS

- Physiologic spectrum wide
- Expected outcome of a specific lesion and sequelae
  - (Arrythmia, ventricular dysfunction, hemodynamic residua, pulmonary vascular disease)
- Formulation of anesthetic plan
- Response to provocative conditions
  - general
  - Specific
- Successes in surgery create later challenges for anesthesiology