

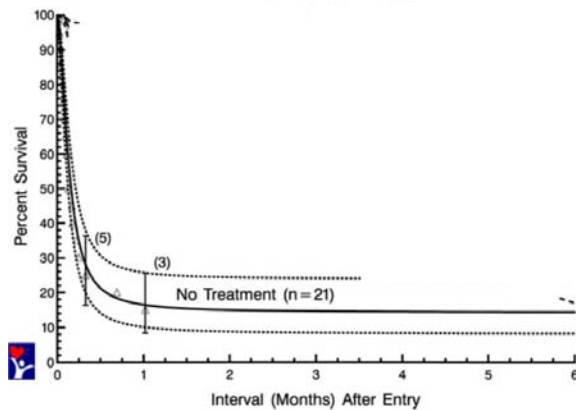
CONFERENCIAS MAGISTRALES
Vol. 30. Supl. 1, Abril-Junio 2007
pp S82-S87

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

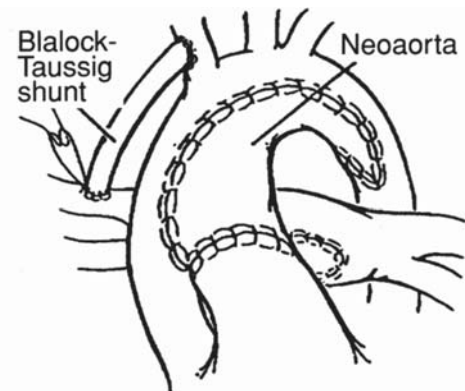
William J. Greeley, MD

The Children's Hospital of Philadelphia. Department of Anesthesia. University of Pennsylvania School of Medicine

HLHS - circa 1980

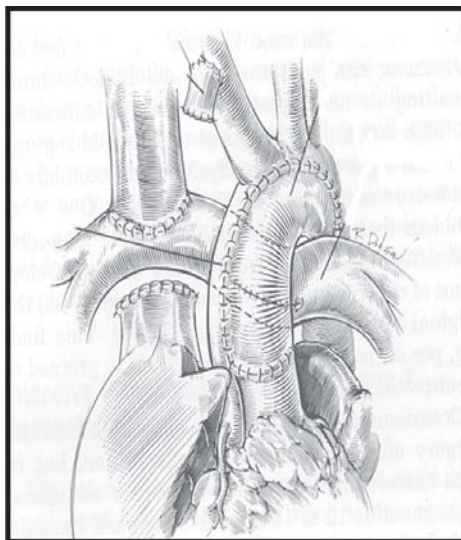


Stage I Procedure

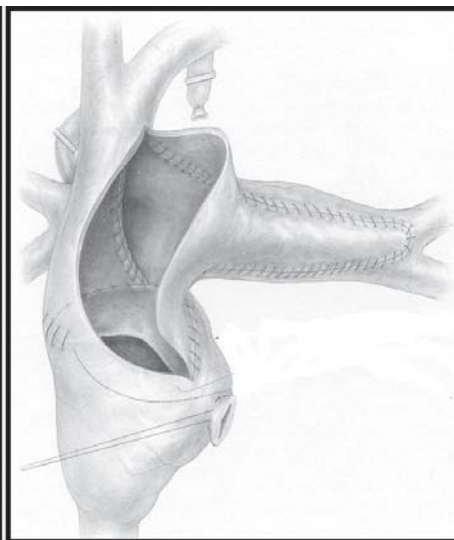


Stage II Procedure

Superior Cavopulmonary Connection with Takedown of B-T Shunt Removes Volume Load on Single Ventricle

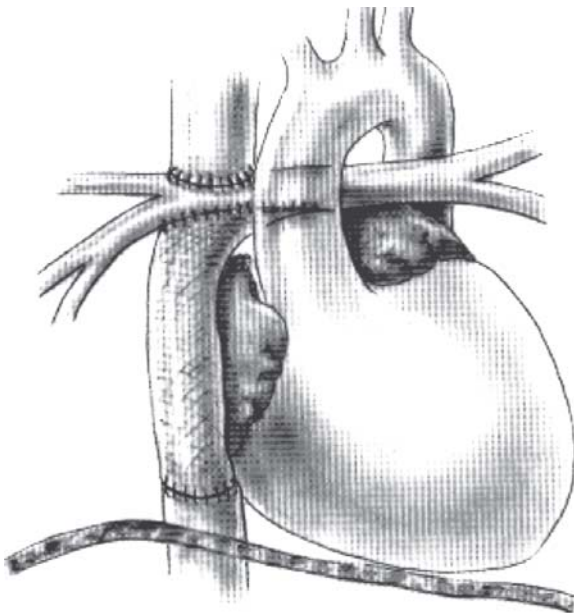


Bidirectional Glenn



Hemi-Fontan

Stage III
Extracardiac Fontan



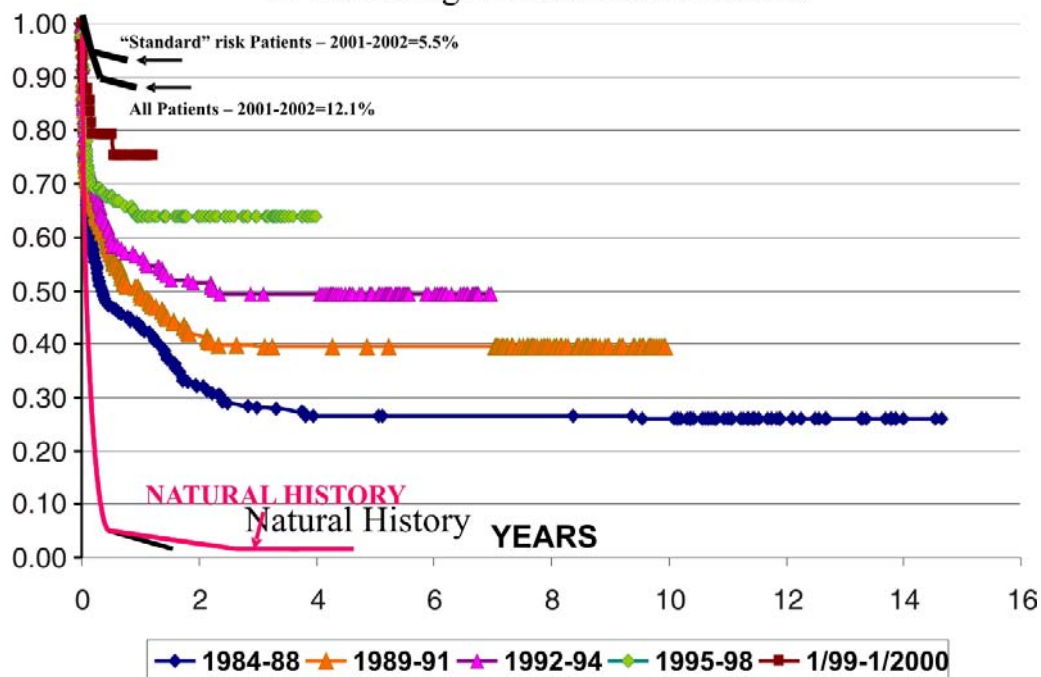
OBJECTIVES

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

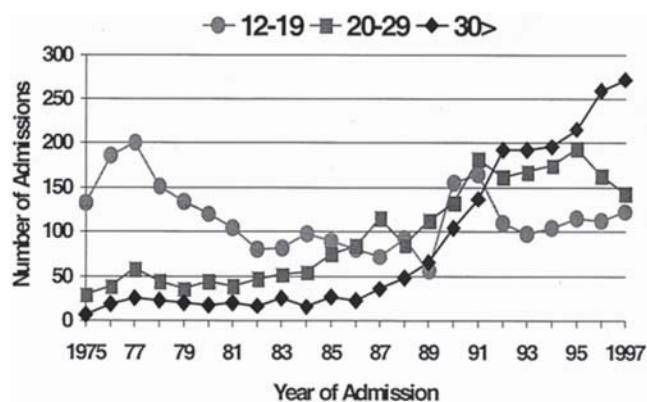
DEMOGRAPHICS OF CHD IN USA

- 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

HLHS- Cumulative Survival - Staged Reconstruction
N=1056 Stage I Norwood Procedures



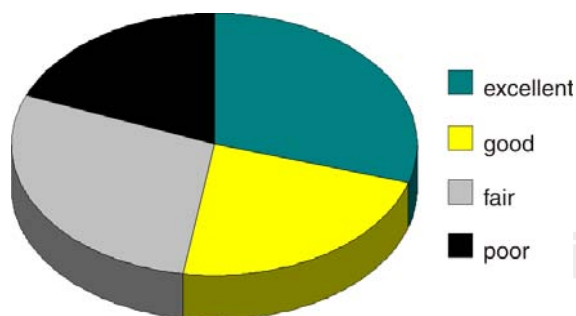
Hospital Admission Rate - Mayo Clinic



PREVALENCE OF CONGENITAL HEART MALFORMATIONS

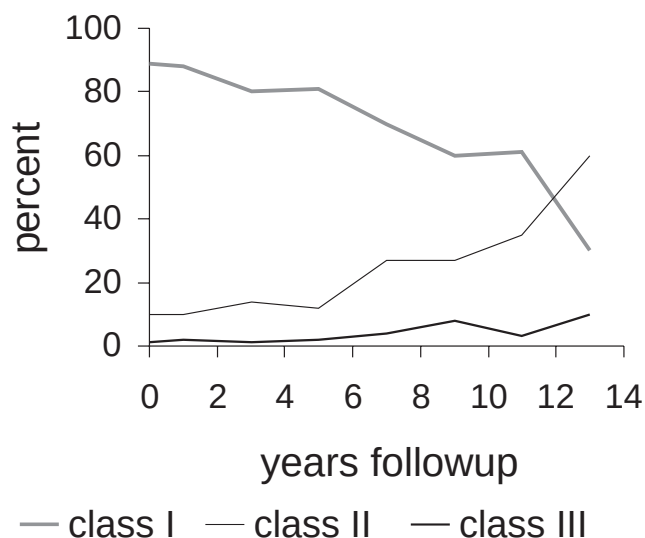
Lesion	Infants (%)	Children (%)	Adults (%)
Ventricular septal defect	28.3	24	15
Patent ductus arteriosus	12.5	15	15.5
Atrial septal defect	9.7	12	16
Coarctation	8.8	4.5	8
Transposition of great art	8	4.5	2
Hyoplastic left heart synd	7.8	—	—
Tetralogy of Fallot	7	11	15.5
Pulmonary stenosis	6	11	15
Aortic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

AORTIC STENOSIS AFTER 25 YEARS



Keane et al, Circulation 87 (supl):I 16, 1993.

FONTAN NYHA CLASS



Fontan F, et al: Circulation 81:1520, 1990

OBJECTIVES

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

DETERMINANTS OF PHYSIOLOGIC FUNCTION

- Sequelae
- Complications
- Palliation
- Correction

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
- Complications
- Palliation
- Correction

FONTAN OPERATION

- Functional level -NYHA
- Arrhythmia 20 – 30%
- Ventricular function 10 – 20%
- Pulmonary vascular disease 25%
- Hemodynamic sequelae 100%
- Protein losing enteropathy 5 – 10%
- Thromboembolism 15 – 20%

OBJECTIVES

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

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

OBJECTIVES

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

Table I. Personnel and Services Recommended or Required for Regional ACHD Centers

Type of Service or Personnel	Local Care	Regional ACHD Center
Pediatric ACHD cardiologist	Optional	One or several 24/7*
Adult medical ACHD cardiologist	Optional	One or several 24/7*
Mid-level practitioner	Optional	Two/several
Congenital heart surgeon	No	Two/several 24/7*
Cardiac anesthesia	No	Several 24/7*
Echocardiography** Includes TEE, intraoperative TEE (required for surgery)	Refer to regional ACHD center	Two/several 24/7*
Diagnostic catheterization**	Refer to regional ACHD center	Yes 24/7*
Noncoronary interventional catheterization**	Refer to regional ACHD center	Yes 24/7*
Electrophysiology**	Consult regional ACHD center unless unrelated to CHD	Yes 24/7*
Exercise testing	Standard	Echo, radionuclide, cardiopulmonary, metabo
Transplant	Optional	Heart, lung, heart-lung desirable
Cardiac imaging/radiology services	Optional	CT scan, cardiac MRI with fast-pulse sequen nuclear medicine

Cardiac pathology
Information technology
Other

Optional
Optional
• Interface with regional
ACHD center
• Data collection
• Participation in patient-care
and best- practice
guidelines review

Yes
• Data collection
• Database support
• Interface with local practitioners,
including internet-based applications
• Quality assessment review and protocols
• Optional development of best practice guid
• Adolescent transitional unit
• High risk obstetrics
• Genetics
• Rehabilitation services
• Social services
• Vocational services
• Financial counselors

* «24/7» denotes availability 24 hours/day, 7 days/week. **These modalities must be supervised/performed and interpreted by physicians with specific skills and knowledge.

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
- 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, Trendelenburg

- 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
 - (Arrhythmia, 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

