**Supplemental Table 1. Variation in Cumulative Pre-Fontan Variables**

|  |  |  |
| --- | --- | --- |
|  | **Aggregate Data** | **Center-level Data** |
| **Variable** | **Rate** | **Mean ­(SD)** | **Median (IQR)** | **Number of Centers\*** | **Median** | **Interquartile Range** | **Range** |
| Shunt type at end of Norwood†  |  |  |  |  |  |  |  |
|  MBTS | 47% |  |  | 14 | 43% | 35-54% | 20-57% |
|  RVPAS | 53% |  |  | 14 | 57% | 46-65% | 43-80% |
| Age at Fontan, yrs |  | 2.9 (0.8) | 2.9 (2.3-3.4) | 14 | 3.1 | 2.7-3.3 | 1.7-3.9 |
| Weight at Fontan, kg‡  |  | 12.9 (2.2) | 12.7 (11.4-14.1) | 14 | 13.0 | 12.7-13.4 | 11.0-14.8 |
| Weight-for-age z-score‡  |  | -0.58 (0.99) | -0.52 (-1.32-0.07) | 14 | -0.56 | -0.71- -0.33 | -1.35-0.44 |
| Genetic abnormality‡  | 4% |  |  | 6 | 7% | 3-7% | 2-27% |
| Associated anatomic diagnosis | 20% |  |  | 14 | 21% | 18-29% | 2-47% |
| Cardiac catheterization performed‡  | 90% |  |  | 14 | 100% | 100-100% | 54-100% |
| Catheterization intervention prior to Fontan | 49% |  |  | 14 | 53% | 44-71% | 13-91% |
| 0 | 51% |  |  | 14 | 47% | 29-56% | 9-88% |
| 1 | 27% |  |  | 14 | 32% | 24-40% | 10-50% |
| 2 | 9% |  |  | 10 | 13% | 9-18% | 2-20% |
| 3 | 6% |  |  | 9 | 9% | 7-14% | 6-20% |
| 4 | 4% |  |  | 5 | 17% | 6-18% | 3 20% |
| 5 or more | 4% |  |  | 4 | 9% | 5-17% | 3-23% |
| Type of prior Stage II† |  |  |  |  |  |  |  |
| Bidirectional Glenn | 59% |  |  | 12 | 86% | 57-96% | 35-100% |
| Bilateral bidirectional Glenn | 11% |  |  | 9 | 11% | 7-13% | 4-59% |
| HemiFontan | 26% |  |  | 5 | 47% | 30-80% | 13-94% |
| Other | 4% |  |  | 9 | 6% | 3-13% | 2-20% |

 \* Number of centers refers to the number out of the 14 centers that used a particular practice or type of care.

 † Aggregate data sample size was 320 except where indicated

 ‡ Weight at Fontan, n=287; weight-for-age z-score,n=268; genetic abnormality, n=256; cardiac catheterization performed, n=287. For all variables with missing data, the rate is calculated as a proportion of available data, not overall.

 MBTS: modified Blalock-Taussig shunt; RVPAS: right ventricle-to-pulmonary artery shunt

**Supplemental Table 2. Variation in Cumulative Pre-Fontan Variables: Anatomic Diagnoses and Catheterization Anatomies**

|  |  |  |
| --- | --- | --- |
|  | **Aggregate Data** | **Center-level Data** |
| **Variable** | **Rate** | **Mean ­(SD)** | **Median (IQR)** | **Number of Centers\*** | **Median** | **Interquartile Range** | **Range** |
| Associated anatomic diagnosis† | 20% |  |  | 14 | 21% | 18-29% | 2-47% |
|  Number of associated diagnoses |  |  |  |  |  |  |  |
|  0 | 80% |  |  | 14 | 79% | 71-82% | 53-98% |
|  1 | 16% |  |  | 12 | 17% | 13-27% | 6-40% |
|  2-5 | 4% |  |  | 11 | 7% | 3-12% | 2-20% |
|  Type of associated diagnosis  |  |  |  |  |  |  |  |
| Atrial septum, restrictive | 9% |  |   | 10 | 15% | 7-20% | 5-28% |
| Other  | 6% |  |   | 9 | 7% | 4-10% | 2-22% |
| SVC, left | 5% |  |   | 7 | 9% | 6-11% | 4-25% |
| IVC, interrupted | 1% |  |   | 4 | 4% | 2-5% | 2-6% |
| Aorta, interruption | 1% |  |   | 1 | 14% | - | - |
| Azygous continuation of the IVC | 1% |  |   | 3 | 6% | 4-7% | 4-7% |
| Pulmonary veins, anomalous  | 1% |  |   | 2 | 7% | 2-13% | 2-13% |
| Pulmonary artery, branch stenosis | 1% |  |   | 1 | 29% | - | - |
| SVC, absent right | 1% |  |   | 2 | 6% | 6-7% | 6-7% |
| Innominate vein, absent  | 0.3% |  |   | 1 | 4% | - | - |
| Catheterization anatomy‡  |  |  |  |  |  |  |  |
|  | Bilateral SVC | 10% |  |  | 10 | 10% | 7-25% | 2-40% |
|  | SVC abnormalities | 4% |  |  | 4 | 11% | 6-18% | 6-20% |
|  | Right and left hepatic veins confluent with IVC | 38% |  |  | 11 | 60% | 7-89% | 3-100% |
|  | Separate right and left hepatic vein drainage | - |  |  | - |  |  |  |
|  | IVC abnormalities | 2% |  |  | 5 | 4% | 3-7% | 3-7% |
|  | Pulmonary artery abnormality | 29% |  |  | 14 | 29% | 20-35% | 13-56% |

 \* Number of centers refers to the number out of the 14 centers that used a particular practice or type of care.

 † Aggregate data sample size was 320 except where indicated

 ‡ Catheterization anatomy n ranged from 162 subjects (for ‘Separate right and left hepatic vein drainage’) to 259 (all others). For all variables with missing data, the rate is calculated as a proportion of available data, not overall.

 MBTS: modified Blalock-Taussig shunt; RVPAS: right ventricle-to-pulmonary artery shunt

**Supplemental Table 3. Variation in Fontan Postoperative Variables: Catheterization Interventions and Surgical Procedures**

|  |  |  |
| --- | --- | --- |
|  | **Aggregate Data** | **Center-level Data** |
| **Variable** | **Rate** | **Mean (SD)** | **Median (IQR)** | **Number of Centers\*** | **Median** | **Interquartile Range** | **Range** |
| Post-Fontan catheterization interventions | 7% |  |  | 8 | 9% | 6-11% | 6-14% |
|  Number of post-Fontan catheterizations |  |  |  |  |  |  |  |
|  0 | 93% |  |  | 14 | 94% | 90-100% | 86-100% |
|  1 | 6% |  |  | 8 | 7% | 6-8% | 3-10% |
|  2-5 | 2% |  |  | 4 | 4% | 2-6% | 2-7% |
| Type of post-Fontan catheterizations |  |  |  |  |  |  |  |
| Coil | 4% |  |  | 6 | 6% | 5-7% | 3-8% |
| Stent | 3% |  |  | 5 | 6% | 3-6% | 3-13% |
| Balloon angioplasty, NOS | 2% |  |  | 3 | 5% | 5-6% | 5-6% |
| Other device implantation | 1% |  |  | 2 | 3% | 3-3% | 3-3% |
| Balloon septostomy | 0.3% |  |  | 1 | 3% | - | - |
| Catheter ablation | 0.3% |  |  | 1 | 3% | - | - |
| Septal occluder | 0.3% |  |  | 1 | 3% | - | - |
| Other post-Fontan surgical procedures | 16% |  |  | 10 | 15% | 13-23% | 7-30% |
|  Number of other surgical procedures |  |  |  |  |  |  |  |
|  0 | 84% |  |  | 14 | 86% | 80-100% | 70-100% |
|  1 | 11% |  |  | 8 | 15% | 9-20% | 3-21% |
|  2-5 | 5% |  |  | 7 | 7% | 3-11% | 2-17% |
| Type of surgical procedures  |  |  |  |  |  |  |  |
| Other | 11% |  |  | 6 | 16% | 6-22% | 3-26% |
| Thoracostomy tube | 6% |  |  | 3 | 14% | 8-22% | 8-22% |
| Pacemaker insertion | 1% |  |  | 4 | 5% | 4-6% | 2-7% |
| ECMO | 1% |  |  | 2 | 3% | 2-3% | 2-3% |
| Fontan fenestration | 1% |  |  | 1 | 7% | - | - |
| Thoracic duct ligation | 1% |  |  | 2 | 8% | 2-14% | 2-14% |
| Ligation of main pulmonary artery | 0.3% |  |  | 1 | 6% | - | - |
| Patch repair of pulmonary artery stenosis | 0.3% |  |  | 1 | 20% | - | - |
| Pericardial window | 0.3% |  |  | 1 | 3% | - | - |
| Permanent pacemaker wires placement | 0.3% |  |  | 1 | 3% | - | - |
| Pleurodesis | 0.3% |  |  | 1 | 1% | - | - |
| Thrombectomy | 0.3% |  |  | 1 | 6% | - | - |
| Tracheostomy | 0.3% |  |  | 1 | 1% | - | - |
| Semilunar valve repair/valvuloplasty | 0.3% |  |  | 1 | 2% | - | - |
| Thoracentesis | 0.3% |  |  | 1 | 6% | - | - |

\* Number of centers refers to the number out of the 14 centers that used a particular practice or type of care.

**Supplemental Table 4. Variation in Readmission after Fontan Variables**

|  |  |  |
| --- | --- | --- |
|  | **Aggregate Data** | **Center-level Data** |
| **Variable** | **Rate** | **Mean (SD)** | **Median (IQR)** | **Number of Centers\*** | **Median** | **Interquartile Range** | **Range** |
| Readmissions | 10% |  |  | 10 | 13% | 11-14% | 4-29% |
| Primary readmission diagnosis |  |  |  |  |  |  |  |
|  | Respiratory | 7% |  |  | 9 | 8% | 5-16% | 3-33% |
|  | Infectious | 3% |  |  | 4 | 7% | 6-10% | 6-11% |
|  | Cardiac general | 1% |  |  | 2 | 4% | 2-7% | 2-7% |
|  | Gastrointestinal | 1% |  |  | 2 | 4% | 3-6% | 3-6% |
|  | Neurological | 0.3% |  |  | 1 | 6% | - | - |
| Secondary readmission diagnosis  | 2% |  |  | 5 | 3% | 3-4% | 2-6% |
|  Respiratory | 2% |  |  | 4 | 3% | 2-5% | 2-6% |
|  Gastrointestinal | 0.3% |  |  | 1 | 6% | - | - |
|  Infectious | 0.3% |  |  | 1 | 2% | - | - |

\* Number of centers refers to the number out of the 14 centers that used a particular practice or type of care.

† 6 subjects each had two readmissions, providing 38 readmission visits from 32 subjects.

**Supplemental Table 5. Variation in Readmission after Fontan Variables: Catheterizations, Surgical Procedures, and Complications**

|  |  |  |
| --- | --- | --- |
|  | **Aggregate Data** | **Center-level Data** |
| **Variable** | **Rate** | **Mean (SD)** | **Median (IQR)** | **Number of Centers\*** | **Median** | **Interquartile Range** | **Range** |
| Catheterization performed | 1% |  |  | 2 | 3% | 3-3% | 3-3% |
|  Catheterization Intervention\*  |  |  |  |  |  |  |  |
| Coil, Aorta to PA collateral  | 1% |  |  | 1 | 5% | - | - |
| Coil, Systemic vein  | 0.3% |  |  | 1 | 3% | - | - |
|  Indication‡  |  |  |  |  |  |  |  |
| Excessive pulmonary blood flow | 1% |  |  | 1 | 5% | - | - |
| Collateral blood flow | 0.3% |  |  | 1 | 3% | - | - |
| Surgical procedures  | 2% |  |  | 4 | 5% | 4-6% | 3-6% |
|  | Thoracostomy tube | 2% |  |  | 3 | 3% | 2-12% | 2-12% |
|  | Other† | 1% |  |  | 2 | 3% | 3-4% | 3-4% |
|  | Pleurodesis | 0.3% |  |  | 1 | 2% | - | - |
| Significant complications  | 2% |  |  | 5 | 6% | 3-6% | 3-6% |
|  | Respiratory | 2% |  |  | 3 | 9% | 6-11% | 6-11% |
|  | Cardiac general  | 0.3% |  |  | 1 | 3% | - | - |
|  | Neurological | 0.3% |  |  | 1 | 6% | - | - |
|  | Infectious | 0.3% |  |  | 1 | 3% | - | - |

\*Among the two subjects having catheterizations during a readmission, data on type and indication were missing from one patient.

† Other surgical procedures included left hemi-diaphragm plication and lysis of adhesions from one patient, and mediastinal exploration with debridement from another patient

**Supplemental Table 6: Number of Subjects Per Center**

|  |  |
| --- | --- |
| **Center** | **Number of Subjects** |
| 1 | 6 |
| 2 | 35 |
| 3 | 30 |
| 4 | 63 |
| 5 | 17 |
| 6 | 16 |
| 7 | 5 |
| 8 | 15 |
| 9 | 35 |
| 10 | 48 |
| 11 | 14 |
| 12 | 17 |
| 13 | 14 |
| 14 | 5 |
| Total | 320 |

**Supplemental Table 7: Single Ventricle Reconstruction Trial Participants**

National Heart, Lung, and Blood Institute: Gail Pearson, Victoria Pemberton, Rae-Ellen Kavey\*, Mario Stylianou, Marsha Mathis\*.

##### Network Chair: University of Texas Southwestern Medical Center, Lynn Mahony

Data Coordinating Center: *New England Research Institutes*, Lynn Sleeper (PI)\*, Sharon Tennstedt (PI)\*, Steven Colan\*, Lisa Virzi\*, Patty Connell\*, Victoria Muratov\*, Lisa Wruck\*, Minmin Lu\*, Dianne Gallagher\*, Anne Devine\*, Julie Schonbeck\*, Thomas Travison\*, David F. Teitel\*.

Core Clinical Site Investigators: *Children’s Hospital Boston*, Jane W. Newburger (PI), Peter Laussen\*, Pedro del Nido, Roger Breitbart, Jami Levine, Ellen McGrath, Carolyn Dunbar-Masterson, John E. Mayer, Jr., Frank Pigula, Emile A. Bacha, Francis Fynn-Thompson; *Children’s Hospital of New York*, Wyman Lai (PI), Beth Printz\*, Daphne Hsu\*, William Hellenbrand, Ismee Williams\*, Ashwin Prakash\*, Seema Mital\*, Ralph Mosca\*, Darlene Servedio\*, Rozelle Corda, Rosalind Korsin\*, Mary Nash\*; *Children’s Hospital of Philadelphia*, Victoria L. Vetter (PI), Sarah Tabbutt\*, J. William Gaynor (Study Co-Chair), Chitra Ravishankar, Thomas Spray, Meryl Cohen, Marisa Nolan, Stephanie Piacentino, Sandra DiLullo\*, Nicole Mirarchi\*; *Cincinnati Children’s Medical Center*, D. Woodrow Benson\* (PI), Catherine Dent Krawczeski, Lois Bogenschutz, Teresa Barnard – deceased, Michelle Hamstra, Rachel Griffiths, Kathryn Hogan, Steven Schwartz\*, David Nelson, Pirooz Eghtesady\*; *North Carolina Consortium: Duke University, East Carolina University, Wake Forest University*, Page A. W. Anderson (PI) – deceased, Jennifer Li (PI), Wesley Covitz, Kari Crawford\*, Michael Hines\*, James Jaggers\*, Theodore Koutlas, Charlie Sang, Jr., Lori Jo Sutton, Mingfen Xu; *Medical University of South Carolina*, J. Philip Saul (PI)\*, Andrew Atz (PI), Girish Shirali\*, Scott Bradley, Eric Graham (PI), Teresa Atz, Patricia Infinger; *Primary Children’s Medical Center and the University of Utah, Salt Lake City, Utah*, L. LuAnn Minich (PI), John A. Hawkins-deceased, Michael Puchalski, Richard V. Williams, Peter C. Kouretas, Linda M. Lambert, Marian E. Shearrow, Jun A. Porter\*; *Hospital for Sick Children*, *Toronto*, Brian McCrindle (PI), Joel Kirsh, Chris Caldarone, Elizabeth Radojewski\*, Svetlana Khaikin, Susan McIntyre, Nancy Slater; *University of Michigan*, Caren S. Goldberg (PI), Richard G. Ohye (Study Chair), Cheryl Nowak\*; *Children’s Hospital of Wisconsin and Medical College of Wisconsin*, Nancy S. Ghanayem (PI)\*, James S. Tweddell, Kathleen A. Mussatto, Michele A. Frommelt, Peter C. Frommelt, Lisa Young-Borkowski.

Auxiliary Sites: *Children’s Hospital Los Angeles*, Alan Lewis (PI), Vaughn Starnes, Nancy Pike; *The Congenital Heart Institute of Florida (CHIF)*, Jeffrey P. Jacobs (PI), James A. Quintessenza, Paul J. Chai, David S. Cooper\*, J. Blaine John, James C. Huhta, Tina Merola, Tracey Griffith; *Emory University*, William Mahle (PI), Kirk Kanter, Joel Bond\*, Jeryl Huckaby; *Nemours Cardiac Center*, Christian Pizarro (PI), Carol Prospero; Julie Simons, Gina Baffa, Wolfgang A. Radtke; *University of Texas Southwestern Medical Center*, Ilana Zeltzer (PI), Tia Tortoriello\*, Deborah McElroy, Deborah Town.

Angiography Core Laboratory: *Duke University*, John Rhodes, J. Curt Fudge\*

Echocardiography Core Laboratories*: Children’s Hospital of Wisconsin*, Peter Frommelt; *Children’s Hospital Boston,* Gerald Marx.

Genetics Core Laboratory: *Children’s Hospital of Philadelphia*, Catherine Stolle.

Protocol Review Committee: Michael Artman (Chair); Erle Austin; Timothy Feltes, Julie Johnson, Thomas Klitzner, Jeffrey Krischer, G. Paul Matherne.

Data and Safety Monitoring Board: John Kugler (Chair)\*; Rae-Ellen Kavey\*, Executive Secretary; David J. Driscoll, Mark Galantowicz\*, Sally A. Hunsberger, Thomas J. Knight, Holly Taylor, Catherine L. Webb\*.

\*no longer at the institution listed

**Supplemental Figure 1. Initial Classification Tree for Median LOS <10 Days vs. ≥10 Days by Center**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Median LOS** |  |  |  |  |  |  |
|  |  |  |  |  | **Category** | **N\*** | **%** |  |  |  |  |  |  |
|  |  |  |  |  | Median LOS <10 days  | 7 | 50% |  |  |  |  |  |  |
|  |  |  |  |  | Median LOS ≥10 days | 7 | 50% |  |  |  |  |  |  |
|  |  |  |  |  | Total | 14 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Pleural Effusion >7 days, <6% of Subjects** |  |  |  | **Pleural Effusion >7 days,≥6% of Subjects** |  |  |
| **Median LOS** | **N** | **%** |  |  |  | **Median LOS** | **N** | **%** |  |  |
| <10 days  | 5 | 100% |  |  |  | <10 days  | 2 | 22% |  |  |
| ≥10 days | 0 | 0% |  |  |  | ≥10 days | 7 | 78% |  |  |
| Total | 5 |  |  |  |  | Total | 9 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | **Postoperative Complications,** **<40.6% of Subjects** |  | **Postoperative Complications,** **≥40.6% of Subjects** |
|  |  |  | **Median LOS** | **N** | **%** |  | **Median LOS** | **N** | **%** |
|  |  |  | <10 days  | 2 | 50% |  | <10 days  | 0 | 0% |
|  |  |  | ≥10 days | 2 | 50% |  | ≥10 days | 5 | 100% |
|  |  |  | Total | 4 |  |  | Total |  5 |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Age at Fontan, <2.9 years** |  | **Age at Fontan, ≥2.9 years** |  |  |  |
| **Median LOS** | **N** | **%** |  | **Median LOS** | **N** | **%** |  |  |  |
| <10 days  | 2 | 100% |  | <10 days  | 0 | 0% |  |  |  |
| ≥10 days | 0 | 0% |  | ≥10 days | 2 | 100% |  |  |  |
| Total |  | 2 |  |  | Total |  | 2 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

\*N refers to the number of centers having median length of stay (LOS) <10 days vs. ≥10 days, the median percentage across the 14 centers

**Supplemental Figure 2. Alternative Classification Tree for Median LOS <10 Days vs. ≥10 Days by Center**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Median LOS** |  |  |  |  |  |  |
|  |  |  |  |  | **Category** | **N\*** | **%** |  |  |  |  |  |  |
|  |  |  |  |  | Median LOS <10 days  | 7 | 50% |  |  |  |  |  |  |
|  |  |  |  |  | Median LOS ≥10 days | 7 | 50% |  |  |  |  |  |  |
|  |  |  |  |  | Total | 14 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Pleural Effusion >7 days, <6% of Subjects** |  |  |  | **Pleural Effusion >7 days,≥6% of Subjects** |  |  |
| **Median LOS** | **N** | **%** |  |  |  | **Median LOS** | **N** | **%** |  |  |
| <10 days  | 5 | 100% |  |  |  | <10 days  | 2 | 22% |  |  |
| ≥10 days | 0 | 0% |  |  |  | ≥10 days | 7 | 78% |  |  |
| Total | 5 |  |  |  |  | Total | 9 |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | **Weight-for-Age Z-score, <-0.37** |  | **Weight-for-Age Z-score, ≥-0.37** |
|  |  |  | **Median LOS** | **N** | **%** |  | **Median LOS** | **N** | **%** |
|  |  |  | <10 days  | 1 | 12% |  | <10 days  | 1 | 100% |
|  |  |  | ≥10 days | 7 | 88% |  | ≥10 days | 0 | 0% |
|  |  |  | Total | 8 |  |  | Total | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **DHCA, <57% of Subjects** |  | **DHCA, ≥57% of Subjects** |  |  |  |
| **Median LOS** | **N** | **%** |  | **Median LOS** | **N** | **%** |  |  |  |
| <10 days  | 0 | 0% |  | <10 days  | 1 | 100% |  |  |  |
| ≥10 days | 7 | 100% |  | ≥10 days | 0 | 0% |  |  |  |
| Total |  | 7 |  |  | Total |  | 1 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

\*N refers to the number of centers having median length of stay (LOS) <10 days vs. ≥10 days, the median percentage across the 14 centers

DHCA, deep hypothermic circulatory arrest