National Pediatric Cardiology
Quality Improvement Collaborative

Research Explained

Hospital resource utilization in a national cohort of functionally single ventricle patients undergoing surgical treatment

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ABOUT THIS STUDY

The goals of this study were to:

1. Evaluate hospital resource use in patients with functional single ventricle heart disease from birth to late adolescence.
   a. Evaluate the number of days in the hospital during the first year of life divided into 1 month intervals. This was then subcategorized into the total number of days in the hospital for inpatient hospital stays, outpatient visits, and emergency room visits, as well as individual inpatient, outpatient, and ICU days.
   b. Evaluate the number of days of inpatient hospital stays, outpatient visits, and emergency room visits from 0-18 years of age at 1 year intervals.
   c. Analyze the number of days at home during first year of life
   d. Evaluate the inpatient care length of stay and ICU days after the Fontan operation.
2. Investigate factors associated with fewer days spent at home and greater time in hospital intensive care.

3. Report hospital stays after the Fontan operation and factors associated with post-operative ICU stay and fewer days at home within 6 months of the Fontan operation.

Why is this study important?

- Advances in outcomes for patients with single ventricle heart disease have improved; however, treatment remains resource intensive with considerable burden in terms of time spent in hospital, which has financial and logistical costs.
- There have been prior studies evaluating resource use in functional single ventricle patients, but this has been limited to pre-Fontan patients.
- A complete overview of hospital stays in single ventricle patients that includes cardiac and noncardiac inpatient and outpatient stays and extends from birth until adulthood has not been evaluated before.
- This gap in knowledge limits the ability of clinicians and policy makers to optimize management and allocate resources.
- Main purpose of this study was to assess health care resource utilization from birth until 18 years of age in patients with single ventricle heart conditions.

How was this study performed?

- This is a retrospective review of national data registries that link health records (inpatient and outpatient) in patients within England and Wales.
- Age interval associated risk factors that may have affected hospital stays were explored.
- Patients possessing functional single ventricles were included in the study, while patients who underwent bi-ventricular repair were excluded.

What were the results of the study?

- The final study group included 3037 functional single ventricle patients and 1409 of those had undergone the Fontan operation.
- The majority type of resource use amongst all care episodes was outpatient at 75%. 20% of care episodes were inpatient and 5% were accidents and emergency visits.
  - These episodes were evenly split between cardiac vs. noncardiac in nature.
- An incremental decrease in the number of days of healthcare use was observed within the first year.
  - 25 days spent in hospital during the 1st month
  - 8 days in 2nd month
  - 3-4 days between 3 and 6 months
  - 1-2 days between 7 and 12 months
- The most inpatient and ICU days were during the first 2 months of age
- Outpatient visits in first year of life had a median of 1 day per month.

- Median number of days of health care utilization (inpatient, outpatient, and emergency) decreased from 60 days in the first year of life to fewer than 4 days per year for ages 7-18 with slight increase around 3-6 years of age coinciding with the Fontan operation. Inpatient hospital use showed a similar pattern
- There were 693 deaths (23%) during the first year of life, mostly in-hospital.
  - During this period, 95% had ICU admission and 4.5% had ECMO use
  - Although non-survivors had fewer inpatient days on average (only 10% reached stage 2 palliation, meaning most of deaths were inter stage), they did have longer ICU episodes and more ECMO days.
  - Most of resource use was related to the Stage I procedure
- Factors associated with a greater time spent in ICU included diagnosis subtype, birth prematurity, associated congenital comorbidity (existence of more than one disease or condition), and post-natal diagnosis
- Median inpatient hospital length of stay post Fontan was 13 days, while ICU stay was 2 days.
  - 1.6% of the Fontan population died while in-hospital, with non-survivors having a greater number of inpatient hospital days
- During the first 6 months post-Fontan
  - Majority (63%) had no additional re-admissions.
  - 23% had 1 re-admission in first 6 months.
  - 8% had 2 re-admissions, while 7% had 3 or more re-admissions.
- Markers of illness severity at any time before Fontan operation and longer time on cardiopulmonary bypass during the first year of life were associated with fewer days at home during the first 6 months after the Fontan operation

What were the limitations of the study?

- This was a retrospective study based on patients within England and Wales with a different health care system model so there are likely to be variations in health care delivery, resource utilization, and demographics that would allow for comparison to the US.
- Additionally, this study is complicated by the complex, heterogeneous nature of single ventricle anatomies.

What it all means

- The first month of life is the most critical time period with the greatest number of inpatient hospital days but the research highlights a significant decrease of inpatient hospital days over the lifespan with adolescence transitioning to mostly outpatient based care.
  - This is not unexpected given that most patients with functional single ventricles have lengthy hospital stays during the first year of life.
- Certain subgroups of functional single ventricle patients are high risk and have longer hospitalizations and more frequent outpatient visits.
- Once able to get past the second stage procedure, a significant drop in health care utilization is noted.

- o   This presents a good overall clinical course.
- Data from this study can be used in counseling families especially those with prenatal diagnosis, so that they can understand the average expectancy for time spent in medical facilities.
- This can also help guide policy making and resource utilization aimed at improving hospitalization stays and unplanned admissions during the first year of life