Serial Echocardiograms Reveal Occult Coronary Dilation in Patients with Kawasaki Disease

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Type of submitter

Fellow in Training

Abstract

Background: Kawasaki disease (KD) is an acute childhood vasculitis of unclear etiology that can lead to coronary dilation and aneurysm. Historically, a dichotomous definition for coronary outcomes has existed with either absolute measurements or Z-score cut off being used to differentiate normal from abnormal coronary outcomes. More recently an intermediate group has been described termed “occult dilation” defined as patients with coronary measurements that remain within the normal range based on Z score, but show reductions in size over time suggesting there was coronary involvement, though to a lesser degree than those with definite dilation.

Objective: We sought to perform a descriptive study to further characterize coronary outcomes in patients with KD when considering those with occult dilation and to examine whether clinical data can predict coronary outcomes.

Methods: A retrospective study was performed of all acute KD patients treated with IVIG from October 2012 through November 2016 at our institution. Patients with serial echocardiograms available up to 12 months after diagnosis were included. The proximal LAD and RCA were measured by a single observer (TC) at diagnosis, 2 weeks, 6 weeks and 12 months after diagnosis. Values were normalized for body surface area. Patients were divided into 3 groups by coronary outcome: 1) normal = Z score always < 2 with Z score variation <2, 2) occult dilation = Z score variation > 2 with absolute Z score measurements < 2, and 3) definite dilation any Z score > 2. Clinical data (age, sex, ethnicity, CRP level, duration of fever and response to therapy) were analyzed via univariate analysis between each of the coronary outcome groups.

Results: There were 145 patients who met inclusion criteria. 36/145 (25%) of patients had occult dilation, 16/145 (11%) definite dilation and the remaining 93/145 (64%) were normal (Table 1). Trends in coronary measurements are shown in Figure 1. Patients who presented with prolonged fever (> 10 days) were more likely to have occult or definite dilation (22% and 31% respectively) compared to those with normal coronaries (8%) (p-value = 0.002). Rate of IVIG resistance increased across coronary outcome groups as degree of coronary involvement increased (normal = 8%, occult dilation = 19%, definite dilation = 44%, p-value = 0.0006). There was no statistically significant difference between coronary outcome groups for age, sex, ethnicity or CRP level.

Conclusion: Occult coronary dilation is a common finding in KD patients who have been previously grouped with those who have completely normal coronary outcomes. Patients with any coronary dilation, occult or definite, were more likely to present with prolonged fever and IVIG treatment resistance. Future longitudinal studies are needed to determine long term outcomes for KD patients with occult coronary dilation.

Table 1: KD Coronary Outcome Groups Demographic and Clinical data
<table>
<thead>
<tr>
<th></th>
<th>Normal (n=91)</th>
<th>Occult dilation (n=36)</th>
<th>Dilation (n=16)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>59 (65%)</td>
<td>19 (53%)</td>
<td>10 (62%)</td>
<td>0.45</td>
</tr>
<tr>
<td>Caucasian</td>
<td>51 (62%)</td>
<td>18 (53%)</td>
<td>11 (73%)</td>
<td>0.38</td>
</tr>
<tr>
<td>Age &lt; 12 months</td>
<td>10 (13%)</td>
<td>5 (14%)</td>
<td>5 (25%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Fever ≥10 days</td>
<td>7 (8%)</td>
<td>8 (22%)</td>
<td>5 (31%)</td>
<td>0.002</td>
</tr>
<tr>
<td>IVIG Response</td>
<td></td>
<td></td>
<td></td>
<td>0.0006</td>
</tr>
<tr>
<td>Responder</td>
<td>84 (92%)</td>
<td>29 (80%)</td>
<td>9 (56%)</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>7 (8%)</td>
<td>7 (19%)</td>
<td>7 (44%)</td>
<td></td>
</tr>
<tr>
<td>CRP ≥3</td>
<td>72 (86%)</td>
<td>29 (83%)</td>
<td>11 (73%)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Figure 1: Mean Z score Trend According to Coronary Outcome Group

Proximal LAD

- Normal
- Occult Dilation
- Dilated

Proximal RCA

- Normal
- Occult Dilation
- Dilated

Categories
3rd year Fellow: Research

Program Name
Nationwide Children’s Hospital
Compliance with Appropriate Use Criteria for Pediatric Echocardiography: Experience in a Single Center with an Open Echocardiography Lab

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Type of submitter
Fellow in Training

Abstract

Background: Recommendations for the appropriate use of echocardiography in outpatient pediatrics were published by the American College of Cardiology in conjunction with the American Academy of Pediatrics and other groups in 2014.

Objective: The primary objective of this study is to determine the frequency of adherence to the appropriate use criteria in an open pediatric echocardiography lab. The secondary objective of this study is to assess the applicability of these criteria to the inpatient setting.

Methods: This is a single center prospective cohort study of patients with a first-time transthoracic echocardiogram performed at Nationwide Children’s Hospital from April – July 2016. Medical record review included murmur or chest pain description, past medical history, family history, electrocardiogram findings, and blood culture results. Two cardiologists graded each echocardiogram according to the ACC criteria: Appropriate, May Be Appropriate, and Rarely Appropriate. A third cardiologist reviewed any cases without an initial agreement. Abnormal echocardiogram findings were graded as incidental, mildly abnormal, moderately abnormal, and severely abnormal. Chi-square, Fisher’s exact test, and Chi-square tests for trend were used for statistical analysis with p < 0.05 significant.

Results: Five hundred thirty patients, 30% inpatient, were included in the final analysis. Twenty-nine patients were excluded for lack of clinical information appropriateness grading. Fifty-six percent of studies were ordered by a cardiologist. Seventy-one percent of patients had a single indication and 29% had multiple indications for echocardiogram, with abnormal electrocardiogram (31%) and murmur (24%) most common. Echocardiogram indications were graded as Appropriate in 81%, May Be Appropriate in 7%, and Rarely Appropriate in 12% of patients. Thirty percent of studies were abnormal: 12 (8%) incidental findings, 92 (58%) mildly abnormal, 54 (34%) moderately abnormal, and 1 (1%) severely abnormal. Ninety three percent of patients with abnormal echocardiograms had an appropriately ordered test. Patient, clinician, and location characteristics associated with an appropriately ordered tests included: cardiologist ordered (p < 0.003), inpatient (p = 0.02), multiple indications (p 0.003), and abnormal electrocardiogram (p < 0.0001). Abnormalities were more likely to be found in echocardiograms that were appropriately ordered (p < 0.0001).

Conclusion: Our study demonstrates the need for continued adherence to the appropriate use criteria for initial echocardiograms. Our study shows cardiologists at our institution are highly likely to adhere to the appropriate use criteria. We demonstrate that by adherence to the appropriate use criteria, the majority of patients with abnormal findings will be identified. Indications of murmur, abnormal family history, and syncope were the indications most likely to be classified as rarely appropriate suggesting the continued importance of a thorough history and physical exam for patients.

Categories
Advanced Fellow: Research

Program Name
Nationwide Children's Heart Center
An assessment of pediatric heart transplant admission characteristics and practices using an administrative database

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Abstract

**Background:** Pediatric heart transplantation remains the gold standard of treatment for end-stage pediatric heart failure refractory to medical management. However, given the relative rarity of heart transplantation, between 300 and 400 yearly in the United States, it has been difficult to robustly study practice patterns. An administrative database such as the Pediatric Health Information System (PHIS) spontaneously collects patient diagnoses and procedures by ICD coding, medication charges by day of administration, as well as insurance and cost information that can be used to infer multiple data points regarding these patients. Here, we discuss practice patterns regarding the heart transplant admission using the PHIS database and present a global assessment of the details of pre- and post-transplant care with specific regards to admission or length of ICU care, interventions, and details of immunosuppression in hospital during the initial transplant admission.

**Methods:** A retrospective cohort study of orthotopic heart transplant recipients <19 years from 2003-2017 was performed using the Pediatric Health Information System (PHIS) administrative database. The PHIS database was queried for patient diagnoses and procedures by ICD coding and medication charges by day of administration during admissions where an orthotopic heart transplant was performed.

**Results:** There were 3,214 heart transplants performed over the study period. Of these, 183 (5.7%) died during the initial admission for transplantation. The median length of stay was 52 days with a median ICU length of stay of 22 days. During the post-transplant phase, 95.9% of patients were started on inotropic support any time from postoperative day 1 and after. 60.8% of patients underwent post-transplant catheterization during this admission, with a catheter-based intervention rate of 3.6%. The proportion of recipients who received induction immunosuppression with anti-thymocyte globulin increased over the study period (25.4% to 70.0%). The proportion of patients discharged on a calcineurin inhibitor increased over the study period (42% to 83%) as did the use of mycophenolate (52.3% to 83.6%). Recipients discharged on cyclophosphamide (33.1% to 8.7%) and azathioprine (13.0% to 4.2%) decreased over time. The most common medications not associated with immunosuppression used at discharge were furosemide (69.8%) and amlodipine (33.0%).

**Conclusion:** Pre- and post-transplant care varies across pediatric heart transplant centers and has seen changes over time with advances in care. This study is the first to leverage the PHIS database to provide a global assessment of care of a heart transplant recipient during the transplant admission.

Categories

Advanced Fellow: Research

Program Name

Nationwide Children’s Hospital
Effect of Electromagnetic Interference from an Electric Vehicle Tesla Supercharger Station on Implantable Cardioverter Defibrillators.

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Type of submitter
Fellow in Training

Abstract

Background: Electric vehicles (EV) ownership is increasing worldwide. It is estimated that by year 2020, 20 million EV will be on the road. We previously demonstrated that there is no effect of electromagnetic interference (EMI) from an EV on implantable cardioverter defibrillator (ICD) performance when using an alternating current regular charging station port (17.2 KW, 30 A). The effect of a supercharging station with direct current (120 KW, 85A) has not been evaluated. There are 1,043 Supercharger stations with 7,496 Superchargers in the United States. It is reported they charge EV in less than 30 minutes with 480-volt of direct current providing up to 120 kW of power per car, becoming the favored charging option.

Objective: To assess potential influence of EMI from EV supercharger on ICD performance.

Methods: This was a proof of concept study to explore potential effect of EMI from supercharger stations for EV on ICD. We enrolled 35 patients with stable ICD function; 14% (5/35) were single chamber, 40% (14/35) were dual chamber and 46% (16/35) were biventricular ICDs. 31% (11/35) of these were Medtronic, 51% (18/35) Boston Scientific and 17% (6/35) St Jude Medical. Tesla Model S and Model X were used while charging at supercharging station. ICDs were interrogated before and after the procedure. Tracings were obtained while the patients sat in the driver seat, passenger seat, backseats, and supercharging port at nominal and highest sensitivity settings.

Results: Mean age of patients was 69. ±9.7 (40-86) years; 83% (29/35) were Caucasian, 14% (5/35) African American, 2.8% (1/35) Asian. 77% (27/35) were male. 49% (17/35) patients had an underlying paced rhythm. 19/35 patients had LV systolic dysfunction only (LVSD), 34% (12/35) had LVSD with prior ventricular arrhythmia or cardiac arrest. 11% (4/35) had normal ventricular function. 5% (2/35) had history of syncope. 5% (2/35) has structural heart disease. There was no sensing of EMI at any settings, and no inappropriate ICD shock or damage to the device noted.

Conclusion: In this single-center, in-vivo study, ICD functions were not influenced by EMI from EV while charging at a supercharging station.

Categories
3rd year Fellow: Research

Program Name
Wright State University