Background

• With the advancement in the surgical outcomes after pediatric cardiac surgery, the focus has shifted from the mere survival of patients after the surgical procedure, toward improvement in the neurodevelopmental outcomes following these complex procedures.
• In this follow-up study, we evaluated the role of different anesthetic techniques on the neurodevelopmental outcomes of children who were previously enrolled in a prospective randomized blinded study assessing the role of different anesthetic techniques on the stress response during pediatric cardiac surgery.

Methods

• After IRB approval, patients who previously underwent VSD closure, AVSD repair or TOF repair on cardiopulmonary bypass at age 1 month to 3 years as a part of our stress response study comparing the use of low dose fentanyl (LDF) to high dose fentanyl (HDF) and low dose fentanyl + Dexmedetomidine (LDF+DEX) were identified.
• Of this cohort, patients currently aged 5 years or younger were contacted by phone and enrolled in this study.
• Enrolled subjects were evaluated by our Child Biobehavioral Outcomes Core team at Nationwide Children’s Hospital.
• Intellectual functioning was assessed by administering the Stanford-Binet Intelligence Scales (5th ed).
• During the children’s evaluations, parents were asked to rate adaptive functioning of the children using the Adaptive Behavior Assessment System (ABAS) and psychosocial adjustment using the Child Behavior Checklist.
• The Child Biobehavioral Outcomes Core team was blinded to the different treatment groups during the evaluation process.

Results

• A total of 22 patients (8 in the LDF group, 6 in the LDF+DEX group and 6 in the HDF group) have been evaluated to date with other subjects pending.
• Patients in the HDF group scored the highest in the full scale IQ composite score (P=0.05), working memory standard and raw scores (P=0.03), and nonverbal raw and standard quantitative reasoning scores (P=0.0832).

Results

Patients in the HDF group had the most blunting of the stress hormones that was correlated with a better neurodevelopmental outcome.
• Cortisol level at 24 hours post operatively was statistically lower in the HDF patients (84 ± 58 ng/ml) when compared to LDF at 323 ± 282 ng/ml (P = 0.049).
• Epinephrine level post sternotomy was statistically lower in the HDF (1.4 ± 0.8 ng/ml) than the HDF group (P < 0.01).
• ACTH levels in the HDF group was significantly lower than the LDF group (Figure 1).

Discussion

• To date, data suggests that the patients who received high dose fentanyl had the best neurodevelopmental outcomes.
• The outcomes with the largest (in some cases, significant) differences involve cognitive ability (full scale IQ, verbal IQ, working memory, quantitative reasoning) and early academic skills (ABAS functional pre-academic skills). But this pattern seems to follow in the other cognitive measures as well.
• The data has not shown differences in ratings of behavior problems.
• These are preliminary data, but so far the results point to the fact that the HDF most effectively blunted the stress response. Blunting of the stress response may be associated with improved neurodevelopmental outcome.