

## Hemodynamic Changes with Sevoflurane Induction in Children with Down Syndrome

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**Introduction:** While volatile anesthetics are widely used for inhalational induction of anesthesia in children, bradycardia and arrhythmias have been reported during induction both in the general pediatric population and in patients with Down Syndrome (DS) (1,2). The objective of this retrospective study was to determine whether children with DS are at increased risk of bradycardia and hypotension during and following sevoflurane induction compared to other children.

**Methods:** With IRB approval, the database containing all electronic anesthesia records (Centricity™ GE Healthcare, Waukesha, WI) of children undergoing anesthesia from July 2004 to February 2007 was queried. Data were limited to children < 18 years of age who underwent inhalation induction with sevoflurane. Demographic data for both DS and non-DS patients, and baseline heart rate (HR), Mean arterial pressure (MAP) and oxygen saturation (SpO<sub>2</sub>) were obtained from preoperative anesthesia history and physical exam records. Physiologic data (i.e., HR, MAP and SpO<sub>2</sub>, as well as expired end tidal concentration of sevoflurane [EtSevo]) were collected as q 5 minute median values, and absolute lowest values during the first 30 minutes from initiation of induction. Spurious data points such as HR < 40 /min and MAP <30 mm Hg that were not accompanied by any interventions were excluded from the database to filter artifactual data.

**Results:** Of 12,184 anesthetics in the database, 82 (<1%) had DS. Significantly more children with DS were female (63% vs. 42%), ASA 3-4 (43% vs. 16%), and had a congenital cardiac anomaly (67 vs. 8%). 1063 patients with a history of cardiac anomaly were identified, including 55 children with DS. Both groups were comparable regarding history of repaired cardiac lesion or undergoing cardiac surgery.

The table presents hemodynamic data in the first 30 minutes of induction. The baseline HR was significantly lower in the control group than in the DS group. However, children with DS experienced a significantly lower HR, lower MAP, and greater decreases in HR and MAP from baseline compared to the non-DS group.

When data from children with a cardiac history were analyzed separately, similar HR differences were noted in DS group except there was no significant difference in baseline HR between groups. The DS group had significantly lower median HR in the second 5 minute interval after induction, and had a lower EtSevo during the 4th 5 minute interval.

**Conclusions:** DS patients undergoing sevoflurane induction have greater propensity toward bradycardia and hypotension compared with other children. These findings appear unrelated to the greater prevalence of co-existing cardiac anomalies in the DS group. While pharmacologic interventions for hemodynamic changes were not different, EtSevo was lower following the period of lowest HR in the DS group, suggesting that lowering the anesthetic may have been used as an intervention. It may, therefore, be prudent to adjust inspired sevoflurane concentrations appropriately and monitor these patients with great vigilance.

**References:** 1. Green DH. Br J Anaesth 2000; 85:368; 2. Roodman S. Pediatric Anaesth 2003;13: 538; 3. Borland LM. Pediatr Anaesth 2004; 14:733.

## Physiologic Outcomes in the First 30 Minutes of Induction\*\*

|  | <b>DS Group<br/>(n=72)</b> | <b>Control Group<br/>(n=11,330)</b> |
|--|----------------------------|-------------------------------------|
| Heart Rate                                 |                            |                                     |
| Baseline                                   | 111.9 ± 22.5               | 105.9 ± 23*                         |
| Lowest HR                                  | 83.9 ± 26.3                | 94.6 ± 24.9*                        |
| % Change from baseline                     | -25.8 ± 15.6               | -9.8 ± 17.5*                        |
| >20% Decrease from baseline                | 41 (66%)                   | 2929 (27%)*                         |
| Mean Arterial Pressure                     |                            |                                     |
| Baseline                                   | 70.4 ± 16.0                | 74.7 ± 11.8                         |
| Lowest MAP                                 | 42.3 ± 10.3                | 50.6 ± 10.4*                        |
| % Change from baseline                     | -36.9 ± 16.5               | -30.2 ± 15.3*                       |
| > 30% decreased from baseline              | 31 (66%)                   | 4386 (51%)*                         |
| Oxygen Saturation                          |                            |                                     |
| Baseline                                   | 95.9 ± 5.4                 | 98.2 ± 4.1*                         |
| Lowest SpO2                                | 87.8 ± 11.8                | 93.5 ± 8.9*                         |
| %Decreased from baseline                   | -8.4 ± 10.8                | -4.3 ± 16.9*                        |
| Time to lowest HR                          | 12.6 ± 8.4                 | 12.8 ± 15.8                         |
| Intervention                               | 5 (6%)                     | 397 (3%)                            |
| <b>Data for Those with Cardiac Anomaly</b> |                            |                                     |
|  | <b>DS Group<br/>(n=47)</b> | <b>Control Group<br/>(n=862)</b>    |
| Heart Rate                                 |                            |                                     |
| Baseline                                   | 114.7 ± 23                 | 114.4 ± 25                          |
| Lowest HR                                  | 84.7 ± 28.4                | 100.7 ± 26.1*                       |
| % Change from baseline                     | -24.6 ± 14.3               | -10.1 ± 18.1*                       |
| >20% Decrease from baseline                | 26 (68%)                   | 211 (26%)*                          |
| Mean Arterial Pressure                     |                            |                                     |
| Baseline                                   | 68.8 ± 16.6                | 71.6 ± 13.1                         |
| Lowest MAP                                 | 40.9 ± 10.5                | 46.4 ± 11.3*                        |
| % Change from baseline                     | -35.6 ± 17.4               | -32.8 ± 17                          |
| > 30% decrease from baseline               | 20 (61%)                   | 357 (61%)*                          |
| Oxygen Saturation                          |                            |                                     |
| Baseline                                   | 94.9 ± 6.3                 | 93.8 ± 8.5                          |
| Lowest SpO2                                | 85.2 ± 12.7                | 88.8 ± 11.6*                        |
| % Change from baseline                     | -9.9 ± 11.8                | -4.8 ± 14.4*                        |
| Time to lowest HR                          | 13.4 ± 9                   | 13.7 ± 9.3                          |
| Intervention                               | 4 (7%)                     | 46 (5%)                             |

\*p<0.05 versus DS Group

\*\* excluding children who received vasoactive medications preoperatively