A Review of Pain Control in Pediatric Cardiac Bypass Surgery

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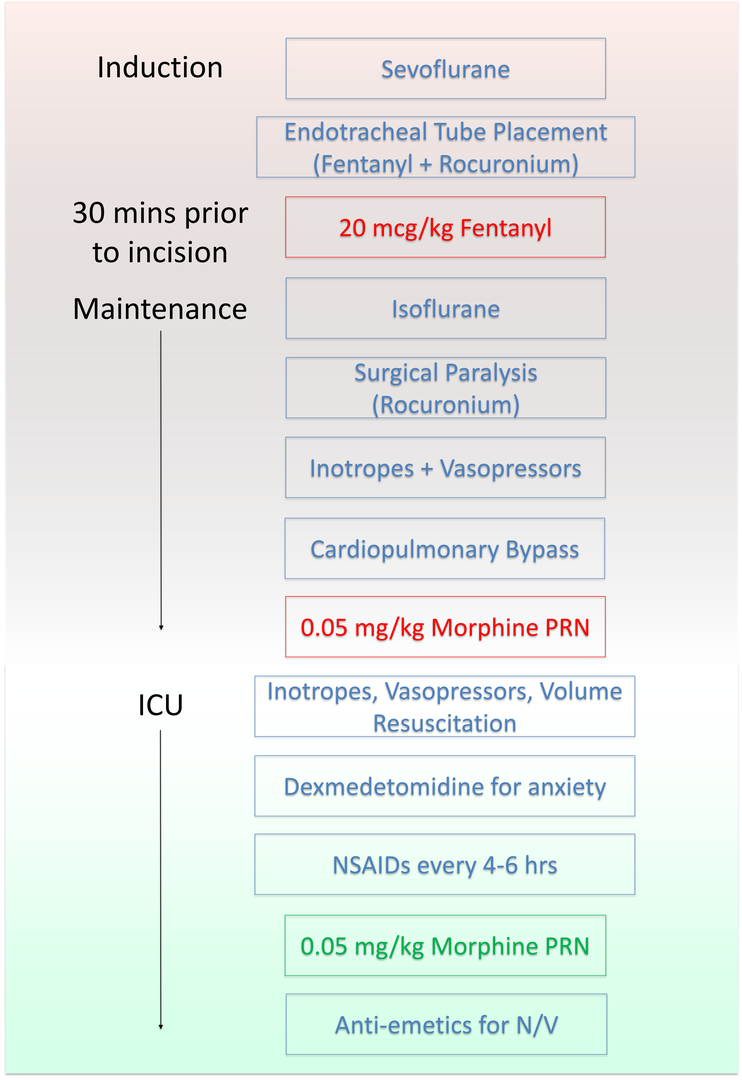
Introduction

Currently, children undergoing cardiac surgery with cardiopulmonary bypass receive inhalation anesthetics and high dose synthetic opioids, such as fentanyl, to reduce the neurohormonal stress and hemodynamic changes due to surgery. Fentanyl is a rapid-acting, highly potent analgesic, however, adverse effects include: respiratory depression, bradycardia, post-operative nausea and vomiting, and opioid tolerance. In addition, the short half-life of fentanyl requires several boluses to be administered throughout the course of the surgery resulting in fluctuating levels of opioids and pain control. Several strategies to advance pain control incorporate regional and neuraxial anesthetic techniques, but the risks of anticoagulation preclude routine use. Alternatively using a longer half-life drug, such as methadone, for analgesia during cardiac surgery decreases the need for several boluses to be administered and has been suggested to reduce the post-operative adverse effects usually associated with opioids.

Abstract

In this study, the opioid requirements during the first 24 hour post-operative period for children who have undergone cardiac surgery and received intraoperative fentanyl were recorded and analyzed. The average morphine requirement in the first 24 hour postoperative period was 0.363 mg/kg, a considerable amount, which reveals a need to explore alternative, long-lasting options for intraoperative analgesia such as methadone.

Current Pain Control Protocol



Results

There were 64 cardiac surgery patients (mean age 4.3±1.7, mean weight 17.1±7.5 kg) who received between 10-30mcg/kg of fentanyl, the mean total dose of morphine in the first 24-hour postoperative period was 0.363mg/kg, with a standard deviation of 0.239.

Discussion

The data from this internal case review of pain control in pediatric cardiac bypass surgery will be used delineate the appropriate sample size for studying postoperative pain control. This is applicable to our study that compares intraoperatively administered fentanyl to methadone on postoperative opioid requirement. This internal case review of 64 cardiac surgery patients (mean age 4.3±1.7, mean weight 17.1±7.5 kg) receiving between 10-30 mcg/kg of fentanyl showed a mean total dose of morphine in the first 24-hour postoperative period was 0.363 mg/kg, with a standard deviation of 0.239. Assuming no difference between the two treatment strategies in the population, a total sample size of 76 in each group will provide 80% power to detect a difference of 0.109 in means, using a two-sample t-test at the 0.05 significance level. The high amount of postoperative morphine required, as determined by this study, reveals the need to find alternative pain control strategies such as opioids with longer half-lives and regional techniques. Exploring the effectiveness of methadone, a long acting opioid, to reduce postoperative adverse effects is an area of future study.

Methods

Electronic medical records were retrospectively reviewed for 64 pediatric patients following cardiac bypass surgery at Children's National Health System from June of 2014 through February of 2016. Inclusion criteria included: age between 1 and 18 years, weight greater than 6 kg, American Society of Anesthesiologists (ASA) status of ASA I, II, or III, and those who received intraoperative fentanyl. Exclusion criteria included: personal or family history of malignant hyperthermia, personal history of hepatic disorders, history of chronic nausea or vomiting, history of pulmonary hypertension, emergency cardiac surgery, respiratory dysfunction, or requirement of supplemental oxygen therapy, history of opioid abuse, addiction or tolerance, allergic reaction to opioids, obesity, and perioperative use of inotropic agents or pacemaker. Intraoperative and postoperative opioid class and dose was recorded for all patients. The data was compiled and analyzed to obtain a mean and standard deviation for future study.

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