

Development of Acute Opioid Tolerance During Infusion of Remifentanyl for Pediatric Scoliosis Surgery

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Review: The goal of the study was to test the hypothesis that continuous intraoperative infusion of remifentanyl is associated with the development of acute opioid tolerance. The investigators of this study examined postoperative morphine consumption, pain scores and sedation scores in adolescents who received for their intraoperative pain management either continuous infusion of remifentanyl or intermittent morphine boluses for scoliosis surgery. This prospective, randomized, double-blind study consisted of 30 patients, aged 12 – 17 yrs old. The patients were American Society of Anesthesiologists (ASA) physical status I or II, and scheduled to undergo posterior instrumentation for correction of idiopathic scoliosis. Exclusion criteria for this study were opioid use within three months prior to surgery, inability to self-administer the opioid using a patient-controlled analgesia (PCA) device, elective postoperative ventilation, or obesity.

Patients were randomized to receive either remifentanyl (15 patients) or morphine (15 patients, control group), during the surgery. In the preoperative period, the patients received instruction on the use of a PCA device and a numeric rating scale (NRS) for assessment of postoperative pain intensity. Patient characteristics were similar between treatment groups.

Premedication was not administered to either group of patients. Seventy percent nitrous oxide in oxygen was administered for intravenous (IV) catheter insertion. Subsequently, an IV induction with propofol 4 mg/kg was performed. In addition, glycopyrrolate 10mcg/kg, morphine 100 mcg/kg, and rocuronium 0.6 mg/kg were administered. For the patients in the remifentanyl group, anesthesia was maintained using a mixture of air and oxygen (70% : 30%), propofol infusion at a rate of 80 – 100 mcg/kg/min, and remifentanyl infusion starting at 0.25 mcg/kg/min and titrating in increments of 0.05 mcg/kg/min on the basis of hemodynamic response. For the patients in the morphine group, anesthesia was maintained using a mixture of air and oxygen (70% : 30%), propofol infusion at a rate of 150 – 200 mcg/kg/min, and intermittent morphine boluses of 50 mcg/kg on the basis of hemodynamic response. In the remifentanyl group, approximately 30 minutes prior to the completion of surgery, morphine 100 mcg/kg IV was administered. At skin closure the remifentanyl infusion was discontinued. Following tracheal extubation patients were transferred to the postanesthesia care unit (PACU), and assessed by either an anesthesiologist or nurse who was blinded to the treatment groups. The patient's pain was assessed and morphine 50 mcg/kg was administered at 5-min intervals until made comfortable. This was followed by initiation of PCA.

The postoperative outcome data included the cumulative morphine consumption, pain scores at rest and on coughing, and sedation scores were recorded every hour for 4 hrs and then every 4 hrs for a total of 24 hrs. Also, episodes of postoperative nausea, vomiting, pruritus, and pyrexia were noted.

Following final analysis of the data this study show that the overall consumption of morphine in the remifentanyl group was significantly greater than in the morphine group throughout the first 24 hrs after surgery ($P < 0.0001$). At 4 hrs following surgery, the cumulative morphine consumption in the remifentanyl group was double that in the morphine group. At 24 hrs after surgery the findings for cumulative morphine consumption in the remifentanyl group was 30% more than that in the morphine group. The incidence of all other variables examined in this study were statistically insignificant.

Comments: This study is the first to demonstrate the development of acute opioid tolerance in adolescent patients undergoing scoliosis surgery. Earlier studies that suggest the occurrence of acute opioid tolerance following intraoperative infusion of remifentanyl were performed in the adult population. On the contrary, there are also a few studies in the adult population that dispute these findings. Additional studies in the pediatric population are necessary to examine the issue of acute opioid tolerance and its association with the use of a continuous remifentanyl infusion.

The use of remifentanyl in the pediatric population as noted in the medical literature is becoming more widespread. The results of this study are important to the pediatric anesthesia provider. The results generated are truly worthy of consideration in one's clinical practice. Whether or not these results alter your current anesthesia practice will be your decision.