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## **Emergence Agitation**

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Emergence agitation is the most common anesthetic complication seen in a pediatric recovery room. Without prophylaxis 25-75% of patients would have postoperative agitation after minor surgical procedures where IV's are not routinely placed such as bilateral myringotomy and tube placement (BMT). These events can be upsetting for parents, nurses and staff and can potentially result in physical injury to all of the aforementioned and the child.

### **Defining Characteristics**

The defining characteristics of emergence agitation include inability to console, inability to control and inability to focus attention. A child with emergence agitation is often seen thrashing their body about wildly, eyes closed, disoriented and unaware of his/her surroundings. Although these behaviors are self-limiting and have little known long term sequelae they represent a quality assurance issue at most pediatric hospitals.

### **Risk Factors**

Factors that increase the incidence of emergence delirium include short procedure duration, fast offset anesthetics[1], pain[2, 3], age less than 6 years[4], and high anxiety in the preoperative period[5]. It is important to note that most studies do not attempt to minimize the incidence of emergence agitation in control groups. Thus, the reported incidences below may appear high.

The risk for emergence agitation is highest in ultrashort procedures where an intravenous line is not routinely placed. The procedures most commonly associated with this problem are placement of pressure equalization tubes and ocular probing and irrigation cases. If no treatment or prophylaxis is offered for these children, as many as 80% may exhibit emergence agitation. Children undergoing longer procedures such as tonsillectomies and hernia repairs also exhibit emergence agitation with reported incidences as high as 50%. Emergence agitation can even occur in a patient undergoing a non painful procedure such as an MRI or echocardiograms. The reported incidence of mild emergence agitation for these patients was found to be as high as 70% depending on anesthetic technique used[6].

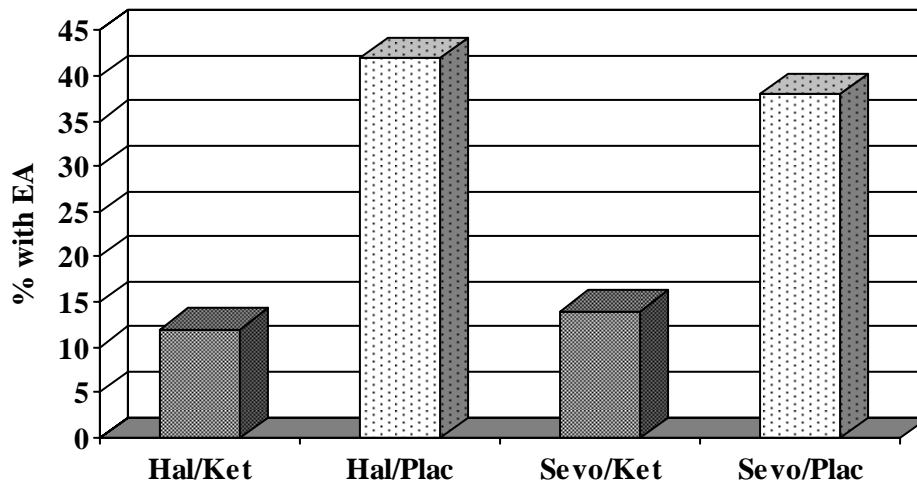
Specific anesthetic agents have been associated with higher incidences of emergence agitation. The use of sevoflurane and desflurane are associated with very high incidences of emergence agitation when compared to halothane[1, 6]. Propofol anesthesia is associated with the lowest incidence of emergence agitation. In one study, the incidence was reported as 0% compared to almost 40% in patients

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receiving sevoflurane.[7] Other intravenous drugs used during anesthesia associated with emergence agitation are ketamine, atropine, droperidol and scopolamine.

Postoperative pain increases the risk of emergence agitation. In fact, in many of the studies mentioned thus far, pain medications were not given or limited resulting in higher incidences of emergence agitation. Difficulties also arise in separating out pain related behavior and emergence agitation. Watcha et al[2] noted that 76% of patients undergoing ear tube placement required supplemental post-operative analgesia. In follow-up Davis et al[3] found that the administration of ketorolac reduced the incidence of emergence agitation from 40% to 10% (figure 1) in children undergoing ear tube placement with a sevoflurane based anesthetic technique. This study supports the hypothesis that pain is an independent risk factor for emergence agitation.

**Figure 1:** Percentage of patients with emergence agitation after myringotomy and tube placement receiving halothane or sevoflurane with and without ketorolac.



Without preventative treatment, preschool-aged children (9 month to six years) have the highest incidence of emergence agitation (40-80%) following ear tube placement[4]. Anxiety in these children may contribute to their high incidence of emergence agitation. Aono et al[5] found that 80% of day case children had emergence agitation versus less than 5% of children who were judged as calm preoperatively. While no long term sequelae have been associated with troubled wake ups in children, postoperative maladaptive behaviors have been noted in children following day case surgery as far out as 4 weeks postoperatively[8, 9].

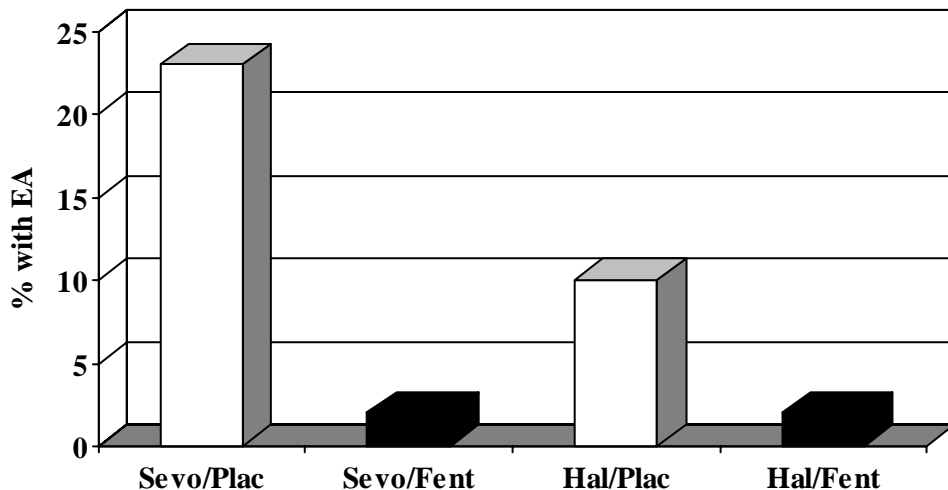
## Treatment Strategies

Treatment strategies for emergence agitation are variable depending on the presence of intravenous access, institutional policies, and the availability and cost of treatments.

Assessing the risk of individual patients is important in determining a plan for decreasing the probability of having emergence agitation. For children with risk factors mentioned above, our institutional preference is to give preventative medications to decrease the incidence of emergence agitation. In children with intravenous access, giving medications to decrease postoperative pain has the most efficacy in preventing emergence agitation. In anxious children, giving oral midazolam 0.2 mg/kg as a premedication may help to decrease the incidence of emergence agitation as shown in a study by Ko et al.[10] Additionally, hospital programs designed to decrease parental and child anxiety may also be beneficial in decreasing preoperative anxiety and postoperative emergence agitation.

The administration of short-acting, rapid onset opioids can decrease the incidence of severe emergence behavior to as low as 2%.[11, 12] Fentanyl 2mcg/kg administered by intranasal route in 4 equal aliquots after the induction of anesthesia can be used to facilitate this figure 2. Ketorolac IV 0.5mg/kg has also been shown to significantly decrease the incidence of emergence behavior.[3] It remains unclear if a long acting (halothane) anesthetic vs. a short acting (sevoflurane) anesthetic changes the frequency of emergence behavior by lengthening emergence time for children following BMT[3, 11, 13]. If emergence agitation occurs despite pretreatment, the use of intravenous fentanyl 1-2mcg/kg is effective for treatment[1].

**Figure 2:** Percentage of patients with emergence agitation after myringotomy and tube placement receiving halothane or sevoflurane with and without fentanyl.



Although emergence agitation is most commonly associated with myringotomy and ear tube placement, it can occur anytime a child receives an anesthetic. It is important to first rule out other causes of postoperative agitation such as hypoxia or pain and treat when appropriate. If emergence agitation is confirmed, opioids can be a very effective treatment. Remember, preventative medications for emergence agitation makes for a much happier PACU staff.

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