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Original Contribution

A randomized trial examining preoperative sedative medication and postoperative sleep in children☆,☆☆,★,★★

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Abstract

Study Objective: Midazolam has been found to have beneficial effects on anxiety in children in the preoperative setting. Prior studies have examined various postoperative behaviors of children, but little research has examined the effects of preoperative use of midazolam with postoperative sleep. The purpose of this investigation was to compare postoperative sleep in children as a function of preoperative sedative medication use.

Design: This study was a 2-group randomized controlled trial.

Setting: Participants were recruited from Yale-New Haven Children's Hospital.

Patients: Participants included a convenience sample of 70 children between the ages of 3 to 12 years undergoing ambulatory tonsillectomy and adenoidectomy.

Interventions: Children were randomly assigned to 1 of 2 groups: a control group who received preoperative acetaminophen only (n = 32) and an experimental group who received both acetaminophen and midazolam preoperatively (n = 38).

Measurements: Parents completed measures of postoperative behavioral recovery and a subset of children wore actigraphs to examine objective sleep data.

Main Results: Children who received midazolam experienced similar sleep changes compared to children in the control group. The actigraph data revealed that children who received midazolam were awake significantly less during the night compared to the control group (P= .01).

Conclusion: Children who received midazolam before surgery had similar postoperative sleep changes compared to children who did not receive midazolam. Further understanding of the postoperative behavioral effects of midazolam on children will help guide healthcare providers in their practice.

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1. Introduction

Millions of children undergo surgery in the United States each year, and up to 65% of children experience significant preoperative anxiety and fear [1]. Although children may experience anticipatory anxiety in the days leading up to the surgical procedure, the day of surgery can be particularly anxiety provoking as children are separated from their parents, removing their primary source of support. Preoperative anxiety has been shown to have negative impacts on both immediate postoperative recovery in the hospital setting and short-term recovery in the home setting [2].

Because of the high incidence of preoperative anxiety in children and its negative postoperative sequelae, various interventions to decrease anxiety have been examined. For example, Kain et al [3] compared the effectiveness of pharmacological and behavioral interventions on children's anxiety. Specifically, findings showed that midazolam was more effective on children's anxiety in the preoperative setting than parental presence, with parents of children who were given midazolam also displaying significantly less anxiety after parting with their children before surgery [3]. Despite such studies demonstrating the benefits of midazolam for children, its use continues to be inconsistent [4]. Relatedly, some studies have shown support for other types of sedative medications other than midazolam, which may result in decreased use of midazolam in children. For example, a recent meta-analysis comparing dexmedetomidine and mizadolam as preanesthetic medications found that dexmedetomidine was more effective in decreasing anxiety and postoperative agitation in children compared to midazolam [5].

It has also been suggested that contradictory of data regarding postoperative outcomes related to midazolam may contribute to its inconsistent use among physicians [6]. Accordingly, Kain et al [6-8] have conducted a number of studies examining the specific postoperative effects of midazolam in a variety of domains. However, 1 area of children's functioning that is still understudied is postoperative sleep. Sleep is essential in all phases of development and is particularly important in childhood [9]. Children have greater sleep requirements, likely necessary to provide increased brain energy for rapid physical growth [10] and brain maturation that occurs throughout childhood [11]. With regard to daily functioning, sleep problems are associated with poor outcomes for children across a variety of behavioral domains, including decreased cognitive performance [12-14] and emotionality, irritable mood, externalizing symptoms, and social problems [15-17].

Although prior studies have examined various postoperative behaviors of children observed and rated by parents, no studies have examined postoperative sleep using an objective sleep measure such as actigraphy. Therefore, the purpose of the present randomized control study was to compare postoperative sleep in children as a function of preoperative midazolam use. It was hypothesized that preoperative midazolam would, at the very least, not be detrimental to postoperative sleep, and given midazolam's beneficial effects on anxiety in the preoperative setting, one might argue for its use if there are no ill effects associated with its administration. Objective sleep data, including actigraphy, were used in addition to parent report postoperative behavioral changes.

2. Materials and methods

2.1. Participants

The sample consisted of a convenience sample of 70 healthy children between 3 and 12 years of age undergoing elective outpatient tonsillectomy and adenoidectomy at Yale-New Haven Children's Hospital between January 2003 and September 2008. The sample in the current study was drawn from a larger randomized controlled trial examining the effects of 4 preoperative interventions (midazolam, family behavioral preparation, midazolam + family behavioral preparation, and control) on children's preoperative anxiety. Power analysis for the larger randomized controlled trial with a standard 2 × 2 factorial design determined that a sample size of 80 subjects per type of preoperative intervention would give 90% power to detect a small effect size of 0.18 for a 2-tailed test at a 0.05 significance level. For the present study, only the control and midazolam groups were included in the present study to exclude potential confounding variables on the primary outcome.

Participant flow through the study is presented in Fig. 1. Exclusion criteria included a history of chronic illness including obstructive sleep apnea, prematurity (<36 weeks gestational age), and developmental delay. Using a simple randomization procedure, children were randomly assigned to a control group who received 15 mg/kg acetaminophen administered orally (n = 32) or an experimental group who received 0.5 mg/kg midazolam with 15 mg/kg acetaminophen administered orally (n = 38). Parents of children who were assigned to the experimental group were notified regarding administration of midazolam as well as a general description of its sedative properties. A written informed consent was obtained from all participants and legal parents or guardians of the participants. The study was approved by the Institutional Review Board at the Yale University School of Medicine/Yale New Haven Hospital.

2.2. Measures

2.2.1. Post Hospitalization Behavior Questionnaire [18,19]

The Post Hospitalization Behavior Questionnaire (PHBQ) is a 27-item parent report questionnaire designed to assess