

Postoperative apnea among premature or anemic infants undergoing inguinal hernia repair

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Abstract

Introduction: Premature or anemic newborns undergoing hernia repair are prone to more postoperative complications than full-term infants. The incidence of respiratory complications among these patients is more than 30%, with postoperative apnea being the most common. Some investigators found that gestational and postconceptional age, the presence of continuing apneic episodes and anemia are the main determinants of postoperative apnea. It seems that infants who do not receive intravenous anesthetics experience less respiratory complications. Intravenous anesthetics have hepatic metabolism for elimination and the immature liver of the premature neonate has not sufficient elimination capacity.

Materials and methods: Study participants were 1047 neonates with post conceptual age (PCA) lower than 60 weeks undergoing inguinal hernia operation. Sevoflurane gas mask was used for anesthesia induction and during deep anesthesia, caudal block was administered using 1cc/kg bupivacaine 2%. The neonates were managed with spontaneous breathing with Sevoflurane gas mask or endotracheal tube until the end of the operation.

Results: In the present study, 916 (87.5%) male and 131 (12.5%) female neonates were included. Mean gestational age and PCA were 36.62 ± 3.80 and 46.80 ± 4.56 weeks respectively. Postoperative apnea did not occur in any patient .

Conclusion: Many studies confirm our findings that inhaled sedative drugs without hepatic or renal metabolism are safe for sedation of premature or anemic infants.

Keywords

- Apnea
- Inguinal hernia
- Premature
- Anemic infant

Introduction

Premature or anemic neonates and infants undergoing hernia repair operation are at risk of postoperative complications compared with full-term neonates.¹ The incidence of respiratory complications among these neonates and infants is more than 30%, with postoperative apnea being the most common.² Inguinal hernia is frequent among premature or low birth weight neonates and infants. Pediatricians have no agreement about the optimal time for inguinal hernia (IH) repair in these cases. Some investigators suggested that surgery must be performed before NICU discharge in order to prevent the risk of incarceration, whereas other clinicians believe that repair should be delayed to minimize anesthetic risks.¹

Several studies reported that postoperative apnea has higher prevalence among neonates and infants with gestational age less than 37 weeks and post-conceptual age less than 60 weeks.^{3,4} Post-operative apnea and oxygen desaturation are life-threatening events which might occur in premature patients after surgery. Apnea is accompanied sometimes by cyanosis, hypotension, brain damage, neurological complications and even death in some cases.⁴

Some investigators found that gestational and post-conceptual age, the presence of continuing apneic episodes and anemia are the main determinants of postoperative apnea.^{5,6}

It seems that neonates and infants who do not receive IV anesthetics experience less respiratory complications. Intravenous anesthetics have hepatic metabolism for elimination and the immature liver of the premature neonates have insufficient elimination capacity. We think that using anesthetics without hepatic metabolism can decrease the rate of respiratory complications among premature patient undergoing IH repair operation. Sevoflurane is the sole anesthetic with respiratory elimination that can be best used for hypnosis. According to this, the present study was performed for assessment of postoperative apnea among premature or anemic patient undergoing inguinal hernia repair

Materials and Methods

The present survey was performed to assess postoperative apnea among premature or anemic patients undergoing IH repair. Study participants were 1047 neonates or infants with post-conceptual age (PCA) lower than 60 weeks undergoing surgery from 2009 to 2014. The study protocol was approved by the research ethical committee of Shahid Beheshti University of medical sciences. We allocated the patients in two groups according to the operation

length. First group, procedure lasting less than 30 minutes (fast group) and second group, surgery longer than 30 minutes (slow group).

Caudal block was performed in all patients. After admission and control of the preoperative condition, two anesthetic methods were selected according to the groups. In the fast group, Sevoflurane gas mask was used for anesthesia induction and during deep anesthesia, caudal block was administered using 1cc/kg bupivacaine 2%. Patients were managed with spontaneous breathing with Sevoflurane gas mask until the end of the procedure. For the slow group, anesthesia induction was the same as for the fast group, but patients were intubated after intravenous injection of atropine 0.02 mg/kg and 2 mg/kg succinylcholine, then caudal anesthesia was injected using 1cc/kg bupivacaine 2% and patients were managed with sevoflurane until the end of the operation, if spontaneous ventilation returned, we allowed and assisted it. Standard anesthetic monitoring was performed in all patients. In the present survey, neither narcotics nor intravenous hypnotics or even nondepolarizing muscle relaxing agents were used in order to decrease the chance of postoperative apnea. Only Sevoflurane was used for hypnosis and regional caudal anesthesia for supplementation of analgesia.

After the operation, the patients were awakened, extubated and transferred to the recovery unit. According to indications, the children were transferred to the ward being controlled by trained nurses and pulse oximeter device. Natural breathing and SpO₂ values were specially controlled. Postoperative apnea was defined by a decrease of SpO₂, less than 90% lasting 10 seconds or more. Apnea monitoring was performed for 12 hours.

Statistical analysis

Study data were entered into the SPSS ver. 20 software for statistical analysis. Description of qualitative and quantitative variables were presented with number and frequency or mean and standard deviation. Independent sample t-test and chi-square were used for analysis and all of P-values less than 0.05 were assumed as significant results.

Results

In the present study, 916 (87.5%) patients were male and 131 (12.5%) were female. Mean gestational age and PCA were 36.62±3.80 and 46.80±4.56 weeks respectively.

Mean birth weight and weight at operation time were 2610.38±774.549 and 4720.37±1453.07 grams respectively.

Mean hematocrit was 29.84±4.22 mg/dl.

Anesthesia with mask was used for 546 (52.2%) and ETT anesthesia method was used for 500 (47.8%) patients.

Mean gestational age (37.04 ± 2.04 vs. 36.24 ± 2.81 , $P < 0.001$), birth weight (2850.07 ± 650.02 vs. 2464.53 ± 808.50 , $P < 0.001$) and PCA (48.80 ± 6.18 vs. 45.07 ± 4.74 , $P < 0.001$) among patients who receive

ETT anesthesia method were significantly higher than patients with mask anesthesia method. Mean hematocrit levels in both groups had no significant difference (29.99 ± 3.78 vs. 29.70 ± 4.59 , $P = 0.26$). Details of comparison of study variables between the groups are summarized in Table 1. Postoperative apnea was not observed in any patient **Table 1**

Table 1: Comparing study variables between Sevoflurane mask and ETT study groups

Variable	Sevoflurane mask	ETT method	P-value
Gestational age	36.24 ± 2.81	37.04 ± 2.04	< 0.001
Birth weight	2464.53 ± 808.50	2850.07 ± 650.02	< 0.001
Post conceptual age	45.07 ± 4.74	48.80 ± 6.18	< 0.001
Hematocrit	29.70 ± 4.59	29.99 ± 3.78	0.26

Discussion

Postoperative apnea was not recorded in any patient. We also found that the two types of anesthesia had a similar impact. Some investigators reported that postoperative apnea had 26.3% incidence rate among neonates and infants undergoing herniorrhaphy with general anesthesia.⁷ In a similar study, the incidence of postoperative apnea was reported to be near 23%.⁸ Presence of apnea among neonates and infants undergoing inguinal herniorrhaphy operation is related to factors such as gestational and post conception age. On the other hand, a patient born at a lower gestational age is more likely to have apnea than one with same post conceptional age but born later. The risk of apnea among premature neonates and infants is lower with the increase of post conceptual age up to 60 weeks post conceptional age.⁹ Apnea among premature patients is exacerbated with hypoxia, intracranial hemorrhage and hyperthermia, upper airway obstruction, heart failure, anemia and anaesthetic

agents.¹⁰ Noted patients demand three-fold post-operative care and present longer unit stay. These infants should not be anaesthetized as outpatient even if regional anesthesia is to be administered. In our study we did not observe any case of postoperative apnea, probably due to insufficient sample size or epidemiological differences between our study and others in patient selection. Our results showed that patients who did not receive intravenous anesthetics experienced less respiratory complications. Premature infants with insufficient hepatic elimination capacity, experience more difficulties with intravenous anesthetic drugs. Our study showed that sevoflurane, that has respiratory elimination, can decrease the rate of respiratory complications.

Conclusion

Many studies confirm our findings that inhaled sedative drugs without hepatic or renal metabolism are safe for sedation of premature or anemic infants.

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