

**Comparative study between a prophylactic single-dose
of Fentanyl and Dexmedetomidine in management of
agitation after Sevoflurane anesthesia in children.**

Thesis

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Abstract

Sevoflurane widely used in pediatric patients.

Sevoflurane commonly associated with agitation in children.

Fentanyl (one of the opioid agonist) is used also in the management of the agitation caused by sevoflurane.

Dexmedetomidine (more selective α -2 adrenoceptor agonist) is used in the management of that agitation.

Comparing the effect of fentanyl and dexmedetomidine in the management of the agitation caused by sevoflurane in children.

Keywords

Agitation, sevoflurane, fentanyl, dexmedetomidine.

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List of abbreviations

ABP.....	Arterial blood pressure
ACTH.....	Adrenocorticotrophic hormone
ADH.....	Antidiuretic hormone
ASA.....	American society of anesthesia
BP.....	Blood pressure
CHIPPS.....	Children's and infants' postoperative pain scale
CO.....	Carbon monoxide
CO ₂	Carbon dioxide
CNS.....	Central nervous system
CSF.....	Cerebrospinal fluid
DEX.....	Dexmedetomidine
EEG.....	Electroencephalogram
ECF.....	Extracellular fluid
ET.....	End-tidal
ETCO ₂	End-tidal CO ₂
F ⁻	Fluoride ions
Fent.....	Fentanyl
GFR.....	Glomerular filtration rate
GIT.....	Gastrointestinal tract
HbA.....	Haemoglobin A
HbF.....	Haemoglobin F
H ₂ O.....	Water
HFIP.....	Hexafluoroisopropanol

HR.....	Heart rate
ICF.....	Intracellular fluid
ICP.....	Intracranial pressure
IV.....	Intravenous
MAC.....	Minimum alveolar concentration
MAP.....	Mean arterial blood pressure
N ₂ O.....	Nitrous oxide
PA-aO ₂	Alveolar- arterial oxygen tension difference
PaCO ₂	Arterial carbon dioxide tension
PACU.....	Postanesthesia care unit
PaO ₂	Arterial oxygen tension
PAP.....	Pulmonary arterial pressure
PCWP.....	Pulmonary capillary wedge pressure
PIEF.....	Pentafluoroisopropenyl fluoromethyl ether
P-value.....	Probability value
RR.....	Respiratory rate
SD.....	Standard deviation
Vd.....	Volume of distribution
Vd/Vt.....	Physiological dead space to tidal volume ratio

Introduction

Introduction

Sevoflurane is used frequently in pediatric patients, when inhalational induction of anesthesia is required, because of its fast and non-irritating effects on the airway. The speed of emergence from sevoflurane anesthesia, however, sometimes presents a dilemma to both patient and anesthetist. In recent studies, a higher incidence of postanesthetic agitation has been attributed to the use of this newer inhalational anesthetic. However, the exact etiology of restlessness after sevoflurane anesthesia is still not know.⁽¹⁾

Postoperative pain is regarded as a contributing factor, but the phenomenon is also present when there is adequate pain control.⁽²⁾ Concern about pain, the presence of strangers or rapid return to consciousness in an unfamiliar environment might themselves further provoke post anesthetic agitation in children. Indeed, this problem is regarded as so severe that some authors have underlined the need for further studies on the safety of sevoflurane, although the drug has distinct benefits in pediatric anesthesia.⁽³⁾

The use of analgesics or sedatives has been proposed for the management of these restless post anesthetic states. However, the side effects of these drugs, including respiratory depression, are potentially harmful and lead to an increased length of stay in the postanesthesia care unit (PACU), resulting in patient discomfort and increased perioperative costs.⁽⁴⁾

Introduction

Emergence agitation phenomena (also called emergence delirium) in children have been the subject of a number of investigations. Several studies have documented an increase in the incidence of emergence agitation when drugs with low solubility are used for anesthesia in children.⁽⁵⁾ Although this problem has not been associated with significant morbidity, marked emergence agitation can negate any advantage rapid emergence from general anesthesia offers. The issue of emergence agitation following the administration of short acting anesthetic agents has become a controversial issue. Part of the controversy stems from definitions. In children, emergence delirium may mimic pain, separation anxiety and / or hunger. The lack of consistent definition and difficulty with reproducing results may make comparisons of different studies difficult.⁽⁶⁾

Sevoflurane in particular has been associated with an increased amount of agitation on emergence from anesthesia in children when compared with a more soluble anesthetic (halothane) even in the absence of any surgical intervention.^(6,7)

Dexmedetomidine has a relatively high ratio of alpha₂ / alpha₁ activity (1620:1 as compared with 220/1 for clonidine), and therefore, is considered a full agonist of the alpha₂ receptor. This may result in more potent effects of sedation without unwanted cardiovascular effects from alpha₁ receptor activation. The 2-h half-life of dexmedetomidine is nearly 4-fold shorter than that of

Introduction

clonidine, which increases the likelihood that a continuous infusion of dexmedetomidine might be useful for sedation.

Dexmedetomidine also has minimum alveolar anesthetic concentration (MAC) sparing properties, but its use as an anesthetic adjuvant has been complicated by persistent hypotension that has mandated intravenous fluid administration and vasopressor administration. In addition, its use in large doses is complicated by hypertension from alpha2 receptor mediated vascular constriction.⁽⁸⁾

This controlled study was performed to test the hypothesis that the prophylactic use of either dexmedetomidine or fentanyl reduces the incidence of emergence agitation after sevoflurane based anesthesia in children.

Aim of the Work

Aim of the Work

This controlled study was performed to test the hypothesis that the prophylactic single dose of either dexmedetomidine or fentanyl reduces the incidence of emergence agitation after sevoflurane based anesthesia in children, and find out which one of them is more effective in reducing this agitation than the other and comparing them to placebo effect.

Review of Literature

Pediatric anesthesia

Pediatric patients present unique anatomic, physiologic and pharmacological consideration. So they deserve special care with respect to these differences from adults.⁽⁹⁾

Physiology

Physiological differences between children and adults are important determinants when planning management of anesthesia in pediatric patients. Monitoring vital signs and organ function during the preoperative period is especially important, as neonates and infants have decreased physiologic reserves.⁽¹⁰⁾

Respiratory system

Control of respiration in newborn infants, especially premature neonates is poorly developed. The incidence of central apnoea (defined as a cessation of respiration for 15 second or longer) is not uncommon in this group especially with a drug with a sedative effect. Unlike the adult, hypoxia in the neonate and small child appears to inhibit rather than stimulate respiration. The newborn has between 20 and 50 million terminal air spaces. At 18 months of age, the adult level of 300 million is reached by a process of alveolar multiplication. Subsequent lung growth occurs by an increase in alveolar size. The lung volume in infants is disproportionately small in relation to body size. Their metabolic rate is nearly twice that of the adult, and therefore ventilatory