

Hemodynamic Shifts in Children During the Induction into Narcosis Period

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Abstract

The article focuses on the study of hemodynamics of children during the period of induction into anesthesia. The analysis of the study results has been carried out – 80 children aged 3 to 14 years undergone medical procedures on diseases of abdominal cavity and anorectal area. The study results have shown that the combination of sevoflurane and ketamine in small doses has caused an effective analgesic effect with a significant vegetative stabilizing effect providing a stable course of the following stages of anesthesia and postanesthetic period.

Keywords: Combined anesthesia, induction period, measurements of central hemodynamic, inhalation anesthetics, fentanyl, ketamine.

Introduction

Induction narcosis is the most essential stage of anesthesia. Mistakes and inaccuracies during the induction narcosis² and its complications may become the very reason for the chain of abnormalities that entail a negative outcome in the future⁷. It is known that medicines applied during the induction period are not neutral for the organism and might become the reason for serious complications due to hard-hitting medicamental effect of the components⁹ of anesthesia on cardiovascular system⁶. Induction period might be accompanied by significant hemodynamic shifts⁵. The most frequent complications of the anesthesia period of children are the disorders of cardiac rhythm and central hemodynamics¹¹.

The purpose of the work is to study the impact of various types of induction on the condition of central hemodynamics during the surgery on abdominal cavity and anorectal area of children⁴.

Materials and Method

The work is based on the analysis of the study results – 80 children aged 3 to 14 years 80. The study has been carried out with children who have undergone surgery because of the diseases of abdominal cavity –

42 children (52,5%) and of anorectal area – 38 children (47,5%).

A complete clinical examination has been held. For the purpose of the objective evaluation of the condition of cardiovascular system a method of echocardiography with the analysis of end-diastolic (EDD) and end-systolic (ESD) dimensions of the left ventricle, R-R interval and ejection time was applied. The study has been carried out using the echocardiograph “Sonoscape” (China, regnumber cfda 20123231386) of patients on the following stages: prior to surgery (initial), post premedication and post-induction.

Premedication was aimed at eliminating anxiety, preventing nausea and vomiting. Atropine sulfate at a dose of 0.01 mg/kg, diphenhydramine - 0.1 mg/kg, sibazon - 0.25 mg/kg and ketamine - 2.0 mg/kg body weight were prescribed as a part of premedication.

Small doses of ketamine (1 mg/kg) and propofol (1 mg/kg) were administered intravenously to patients of the first group in 30-40 minutes post premedication as well as inhalation of sevoflurane at a dose 2,0 – 3,0 vol%.

Before a skin incision, a fentanyl solution of 3 µg/kg was injected intravenously. The maintenance dose

of sevoflurane was 1.5 vol%, the fentanyl dose was 2 µg/kg.

Patients of the second group were exposed to inhalation of isoflurane at a dose 2,0 vol% and intravenous doses of fentanyl of 5 µg/kg and droperidol of 0,4 mg/kg body weight 30-40 minutes post-premedication.

The obtained data has been processed via the set of auxiliary programs Statistica for Windows, Release 5,5 Stat Soft, Inc, with the calculation of arithmetic mean value (M), the average error (m), all digital data has been presented as $M \pm m$. The significance of differences was assessed by Student's criterion (t) with a known number of observations (n). The differences were considered significant at $P < 0.05$.

Results

After the premedication patients of the first group has shown an increase in the measurement of the heart rate frequency (HRF) by 6% ($P < 0,05$), the tendency to an increase in the measurement of the arterial pressure: systolic arterial pressure (SAP) by 2,3%, diastolic arterial pressure (DAP) by 2,9% (Table.1). During the induction period, propofol and sevoflurane have caused fast and smooth induction, a smooth sleep onset within 30-60 seconds of patients has been registered. While the study period, an insignificant decrease of the heart rate frequency measurement by 4,08% has been noticed compared with similar measurements of the premedication stage. The systolic and diastolic arterial pressure measurements were characterized by the downward tendency respectively by 0,7% and 0,9%.

Table 1. Measurements of the HRF, SAP and DAP at the induction anesthesia period with the use of ketamine, propofol and sevoflurane

Measurements	Study Stages		
	Initial	Premedication	Induction
HRF	108,25±7,46	114,75±8,40*	110,06±6,80
SAP	89±8,20	91,06±9,30	90,43±9,15
DAP	45±7,79	46,31±8,56	45,87±7,50
Sp O ₂	95,31±0,60	97,56±0,51*	98,25±0,68*

Note: * Reliability of differences in measurements compared to the original ($P < 0,05$).

Discussion

On a premedication stage patient of the second group have shown an increase in the measurement of HRF by 5,5%. SAP measurements - by 3,0%, DAP measurements - by 1,7%. Isoflurane inhalation has caused a slow induction and the solutions of fentanyl and droperidol have been injected intravenously in this connection. After the fentanyl injection, a respiratory depression has been observed, an auxiliary ventilation has been applied and a tracheal intubation has been implemented after the administration of muscle relaxants. Skin cover was warm and had a regular staining whilst the oxygen saturation indicator increased by 3,9%.

HRF measurement increased by 2,0%, an insignificant increase in the SAP by 1,2% and DAP by 0,2% compared with similar measurements of the original period has been observed (Table 2).

On the background of the administration of medicines for induction – ketamine, propofol and sevoflurane after the trachea intubation an insignificant change in hemodynamics not negatively affecting a hemodynamic system has been observed. Introduction period of general combined anesthesia with the use of small doses of has been characterized by smooth clinical course.

Table 2. Measurements of the HRF, SAP and DAP at the induction anesthesia period of children with the use of isoflurane, fentanyl and droperidol

Measurements	Study stages		
	Initial	Premedication	Induction
HRF	115±2,38	121,33+ 2,87*	118,93+ 3,93*
SAP	88,40±2,69	91,7±2,87	89,5±4,21
DAP	45,16±2,69	45,92±3,51	45,07±4,32
SpO2	95,38±0,58	97,44±0,6*	99,07±0,73

Note: * Reliability of differences in measurements compared to the original (P<0,05).

When conducting a study of the central hemodynamics measurements of patients of the first group, in the introduction period compared with the similar measurements of the initial period, after the trachea intubation the increase in HRF measurements

by 7,6%, CI by 18,5% (P<0,05), some tendency to the increase of SV measurement by 9,3% have been observed. At the same time, a downward tendency to the decrease in the measurements of EF by 5,6% and SPVR by 8,2% has been noted (Table 3).

Table 3. Measurements of central hemodynamics during the anesthesia induction period of children with the use of isoflurane, fentanyl and droperidol (n=40)

Measurements	Initial	Premedication	Induction
EF	70.49±0.85	68.28±1.03	66.55±0.96*
SV	24.59±1.61	22.9±1.31	26.88±1.63
HRF	97.8±2.21	107±2.11*	105.18±1.91*
SPVR	30.29±1.54	32.16±1.77	27.81±1.04**
CI	2.87±0.09	3.02±0.11	3.4±0.1***

Note: * Reliability of differences in measurements compared to the original (P < 0,05).

Table 4 represents the data on the study of central hemodynamics during general anesthesia of children with the use of isoflurane, fentanyl and droperidol.

The increase in the measurements of HRF and Specific peripheral vascular resistance.

Table 4. Measurements of central hemodynamics during the anesthesia induction period of children with the use of isoflurane, fentanyl and droperidol (n = 40)

Measurements	Initial	Premedication	Induction
EF	71.96±1.48	71.51±1.17	72.05±1.4
SV	24.87±1.54	23.56±1.31	23.67±1.35
HRF	96.48±2.07	109.15±2.2*	109.9±2.33*
SPVR	29.7±1.41	25.52±1.25*	26.59±1.42
CI	2.81±0.14	3.08±0.15	3.12±0.17

Note: *Reliability of differences in measurements compared to the original (P < 0,05).

In the introduction period of anesthesia after the trachea intubation compared with the premedication stage only a slight tendency to the measurement change has been noted. In comparison with the initial period, only HRF was subjected to a significant change and increased by 13,9%. Only the SV and SPVR measurements had a downward tendency by 4,8% and 10,5% respectively. Subsequent laryngoscopy and intubation do not cause such a pronounced hyperdynamic response as with induction with ketamine and barbiturates. Hypotension was prevented and eliminated by infusion loading.

The results of the existing study show that the combination of sevoflurane with propofol and ketamine in small doses has caused the effective analgesia with a significant vegetative stabilizing effect associated with central suppression of sympatic activity, and has ensured a stable course of subsequent stages of anesthesia and post-anesthesia period. Patients experienced a rapid restoration of the preoperative level of neuropsychic status after surgery.

Conclusions

1. Insignificant changes of the main measurements of central hemodynamics are contingent to the condition of patients during the introduction period, the trachea intubation and the manipulations taken. The vasodilating properties of propofol and sevoflurane during the introduction narcosis determine a switch hypodynamic reaction of the circulatory system.
2. The evaluation of the clinical course of the introduction period and of the changes of the main measurements of central hemodynamics at conducting the two variants of the combined anesthesia has shown smooth introduction into narcosis and therefore an auxiliary stable course of the subsequent anesthesia stages.
3. Applying small doses of ketamine and propofol coupled with sevoflurane is an optimal method of induction during traumatic and extensive surgery in the abdominal cavity and anorectal area in children.

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Conflict of Interest: Nil

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