

Effect of combined epidural anesthesia in children on hemodynamics with abdominal interventions

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<https://doi.org/10.5281/zenodo.5593706>

Abstract. The article presents the results of assessing the effect of combined epidural anesthesia on hemodynamics during abdominal operations in children with Hirschprugg's and Payr's disease, dolichosigma. The results of the study, carried out according to the multimodal principle, showed the efficacy and safety of combined epidural anesthesia with bupivacaine against the background of low-flow anesthesia with sevoflurane and continuous sedation with propofol in sick children with abdominal surgical pathology.

1 Introduction

Traditional methods of anesthesia cannot fully provide “ideal” intraoperative protection of a child from powerful and prolonged surgical aggression during abdominal operations [1.2.3.4]. The need to revise the standard mono-opioid approach is primarily determined by the disadvantages, side effects of opioids and unmanageable anesthesia [5.6.7]. The progress of surgical technologies has significantly increased the efficiency of surgical treatment and led to the development of a multimodal program of accelerated rehabilitation in surgery Fast track surgery (FTS), which was founded by H. Kehlet (1993). FTS assumed the following aspects to minimize stress reactions and significantly shorten the recovery period of patients: regional anesthesia, minimally invasive surgery, effective pain relief, adequate perioperative infusion, aggressive postoperative rehabilitation (early enteral nutrition and activation of patients) [8-11].

At the current level of development of anesthesiology, the most reliable and controlled antinociception during traumatic operations in the abdominal cavity is provided by combined anesthesia, consisting of controlled general anesthesia in combination with epidural analgesia (EA) [12-15]. This technique not only provides a long-term analgesic profile, but also stimulates the restoration of intestinal motility, reduces postoperative complications, shortens the duration of postoperative recovery and the patient's stay in the

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ICU [16.17]. The awakening of children against the background of persisting analgesia due to the epidural block has a beneficial effect on the psycho-emotional status of the child, contributing to early mobilization and active postoperative recovery [18.19].

There are no studies in the literature on a comprehensive assessment of the effectiveness of multimodal anesthesia and analgesia in the perioperative period during interventions for Hirschsprung's and Payr's disease, dolichosigma in children [20-23]. There is ambiguity and unresolved issues in solving this problem [24.25]. The ongoing search for optimal options for the integrated management of the perioperative period in children with accelerated postoperative rehabilitation has become a prerequisite for conducting our own study to assess the effectiveness of combined EA bupivacaine in combination with propofol (continuous infusion) + sevoflurane (low gas flow) [26.27.28]. The analysis used medical databases Pub Med, Scopus, The Cochrane Library, and our own results.

2 Purpose of the study

The purpose of the study is to examine the effect of combined epidural anesthesia with bupivacaine on hemodynamics in children with abdominal interventions.

3 Materials and methods

A prospective study of combined epidural anesthesia with bupivacaine in combination with propofol and sevoflurane was carried out in 45 children operated on at the clinic of the Tashkent Pediatric Medical Institute in December 2019 - March 2021 for Hirschsprung and Payr's disease, dolichosigma. The average age of the children was 8.2 ± 0.5 years. The work was approved by the local ethics committee of TashPMI, informed consent from the parents was obtained. Preoperative preparation of children for planned operations (84.4%) was carried out in accordance with generally accepted standards in surgery; if necessary, correction of water and electrolyte balance, hemostasis, and intoxication syndrome was performed.

The functional state of the patients corresponded to: class I ASA in 5, II - in 22, III - in 18 patients. The distribution of patients by surgical pathology and age is presented in Table 1. Standard premedication with atropine 0.1% - 0.01 mg / kg, sibazone 0.5% - 0.2 mg / kg, antihistamines were administered according to indications, i / m. Induction was started with propofol 1% - 3 mg / kg, fentanyl 3 μ g / kg, intravenously. Myoplegia - Arduan at a dose of 0.08 mg / kg, IV, followed by tracheal intubation and transfer to artificial lung ventilation (ALV). We started inhalation of sevoflurane - 1 vol% in the composition of oxygen mixture O₂ 60-65%, anesthesia-respiratory apparatus "Fabius Plus" with a capnograph (Drager, Germany). The supply of sevoflurane was gradually increased to 1.5 vol%. Inhalation anesthesia was performed with low gas flow. Then, in the lateral position, the patient underwent puncture and catheterization of the epidural space, at the level (Th10-Th7) using disposable Epidural Minipeak kits (Portax, UK).

Then the patient was laid on his back and bupivacaine 0.5% - 0.3-0.4 mg / kg was administered. Maintenance of anesthesia with propofol 5-6 mg / kg / h, microinfusion pump SN-50C6T (China), continued until the end of the operation. Maintenance of myoplegia by Arduan is fractional, on demand. Evaluation of hemodynamic parameters was carried out by echocardiography (EchoCG) on the APLIO 500 "TOSHIBA" (JAPAN) apparatus at the main stages of the study: minute volume of blood circulation (MVC), heart rate (HR), ejection fraction (PH), mean arterial pressure (MAP)) and stroke volume (SV) Tissue perfusion was assessed in terms of oxygen saturation SpO₂ (pulse oximetry). The study was carried out at stages: stage 1 - in the preoperative ward, before premedication, stage 2 -

induction of anesthesia; Stage 3 - traumatic period; Stage 4 - the end of the operation and awakening, stage 5 - 2 hours after the operation. The distribution of patients by the duration of surgery is shown in Table 2.

Infusion therapy was carried out taking into account blood loss and, accordingly, indicators of blood pressure, heart rate, CVP, urine output. Infusion therapy consisted of Ringer's solution (or saline); for long-term interventions in preschool children, 10% glucose solutions were used. Erythrocyte mass was transfused according to indications. Perioperative monitoring: ECG, blood pressure (non-invasive), SpO2, SevI, SevET, of sevoflurane using the Nihon Kohden multifunctional monitor.

Starting from the moment of awakening, the intensity of pain sensations was assessed using a 10-point digital rating scale (DSR). The restoration of intestinal peristalsis (auscultation) was assessed. Statistical data processing was performed using the Statistica 6.1 statistical software package (StatSoft, USA, 2003).

Results. Operations on the organs of the abdominal cavity, especially for malformations of the gastrointestinal tract, such as Hirschsprung's and Payr's disease, are often characterized by high trauma, duration, often multistage and frequency of postoperative complications.

Table 1. Distribution of patients depending on age, gender and the nature of surgical intervention abs%.

Surgical pathology	Boys				Girls				Total
	1-3	4-7	8-11	12-17	1-3	4-7	8-11	12-17	
Patient age, years									
Hirschsprung's disease	4	6	5	5	4	4			28 (62.2%)
Payr's disease	-	-	-	4	-	-	-	5	9 (20%)
Dolichosigma		1	2	2		1	2		8 (17.8%)
All	4	7	7	11	4	5	2	5	45 (100%)
Total	29 (64.4%)				16 (35.5%)				

The postoperative period in this category of patients is also characterized by certain requirements, namely, the need for adequate pain relief for up to 3-4 days, early restoration of intestinal motility, refusal of enteral feeding, prescribing complete parenteral nutrition with a gradual load of daily calorie intake and correction of water-electrolyte balance.

Table 2. Distribution of patients depending on the duration of the operation.

Anesthesia type	Duration of anesthesia			
	up to 1.5 hours	up to 2.5 hours	≥2.5 hours	Total
Propofol + fentanyl + EA + sevoflurane	9 (20%)	21 (46.6%)	15 (33.3%)	45 (100%)

Therefore, the management of the perioperative period in these patients should correspond as much as possible to the new strategy of Fast Track Surgery (Kehlet H, 1993): the awakening of the patient while maintaining effective analgesia (Guryanov V.A., 2009, Imani F. 2006), which creates a positive psycho-emotional background, promotes active mobilization and has a significant impact on the rate of recovery and the outcome of the disease (Pankratova G.S. 2007).

Stage 1 data corresponded to the initial hemodynamic parameters when the patient was admitted to the preoperative ward before premedication. Changes in hemodynamic parameters are presented.

Table 3. Results of the study of hemodynamics at the stages of research.

indicators	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
SBP	107.8±9.3	117.3±9.4*	121.2±11.4*	113.4±10.9	110.2±9.4
mmHg	59.6±7.7	74.7±10.3*	76.1±10.1*	67.7±10.2*	65.4±9.1
DBP	71.2±7.4	82.1±8.5*	83.2±8.6*	78.3±9.1	74.8±7.2
mmHg	100.5±10.5	106.4±12.6	108.0±12.5	107.7±11.4	103.2±12.4
ADsr	4.3±1.9	5.0±1.7*	5.1±1.3*	4.8±1.8	4.6±2.0
UO, cm ³	43.9±12.2	52.3±17.0	56.1±17.2**	50.3±14.1	48.9±12.5
KDR, cm	3.8±0.7	4.2±0.6*	4.1±0.7*	4.0±0.5*	3.9±0.6
DAC, cm	2.6±0.3	2.7±0.4	2.6±0.6	2.6±0.5	2.5±0.3
FI,	68.3±7.3	71.0±8.4	70.7±10.5	69.3±8.1	69.0±7.3
SpO ₂	99.6±5.7	97.6±3.0	97.1±4.7	98.6±5.7	99.6±7.7

Note: * significant differences in indicators in relation to stage 1 (P<0.05; **P<0.001).

Analysis of hemodynamics showed an increase in SBP, DBP and BP avg at stage 2 (induction and intubation of the trachea) by 8.6%, 24.5% and 14.8%, respectively. HR, IOC, and SV increased simultaneously by 5.8%, 15.5%, and 18.3%, respectively. At stage 3 - the traumatic stage of the operation, a relative stabilization of hemodynamics was noted in relation to the previous stage, and in relation to stage 1 of SBP, DBP, and BP, cf. remained increased by 12.2%, 27.1% and 16.3%, respectively, and were of a reliable nature. HR, IOC and SV remained stable at the stages of maintaining anesthesia, significantly increased in relation to stage 1 by 7.3% (p> 0.05), 17.7% and 26.5%. At the next stage, the awakenings of SBP, DBP and BP avg remained relatively stable, increased towards the outcome with a noticeable decrease in relation to the most traumatic stage of the operation. Thus, SBP, DBP and BP avg decreased in relation to the previous stage by 6.4%, 11% and 5.8%, and in relation to the outcome were increased by 5.1%, 13.4% (p<0, 05), and 9.6%, respectively. Heart rate, IOC and SV at the stage of awakening remained increased in relation to the outcome of 7%, 11.1% and 11.7%, respectively. A significant increase in DBP, MAP at the stages of maintaining anesthesia and awakening indicate the absence of the cardiodepressant effect of sevoflurane in combination with the indicated dosages of propofol in children. In addition, FI was stable throughout all stages of the study, the absence of significant statistically significant fluctuations in FI confirmed the absence of a depressive effect on the performance of the heart and ensuring the body's need for adequate perfusion under the conditions of this method of anesthetic management. At the 5th stage, 2 hours after the operation, 87.9% of children woke up with persistent analgesia due to the epidural block.

Thus, based on the revealed statistically significant increase in SBP, DBP, BP cf. and stable indicators of pulse oximetry during maintenance of anesthesia compared with the outcome, it can be argued that combined epidural anesthesia stabilizes hemodynamics, has a positive effect on systemic and peripheral blood flow, tissue perfusion during abdominal interventions in children. A statistically significant increase in the SV value during and after surgery indicates the absence of a negative effect of the proposed technique on the contractile function of the myocardium. The IOC significantly increased at the 2nd and 3rd stages of the study compared to the initial data, and at the 4th and 5th stages it had an unreliable tendency to decrease. According to our data, there were no significant changes in

heart rate at the stages of the study; therefore, changes in the IOC were associated with SV, which significantly increased during and after anesthesia and indicated the absence of a cardiodepressive effect.

At the stage of awakening, spontaneous breathing was restored 25-30 minutes after the sevoflurane evaporator was turned off (subject to the last administration of a maintenance dose of the muscle relaxant 35-40 minutes before the end of the operation). Some of the patients (42.2%) were extubated in the operating room. In all extubated patients in the operating room, post-anesthetic chills were absent or mild. In 16 cases (35.5%), prolonged mechanical ventilation was performed in the next 5-7 hours, due to the initial aggravated state, the patient's early age and blood loss. In other cases (22.3%), patients were extubated within 1 hour in the ICU. Hemodynamic tension at the stage of awakening against the background of ongoing epidural analgesia was not revealed. All hemodynamic parameters were practically at the level of the initial data. Awakening without pain had a beneficial effect on the psychoemotional state of children and contributed to their early activation and adequate contact with medical personnel. Patients (77.7%) who underwent abdominal-perineal proctoplasty underwent prolonged epidural anesthesia with bupivacaine for 3 days. By the end of 3 days, intestinal peristalsis appeared in patients. The stable course of the postoperative period, early mobilization facilitated the transfer of 32% of patients to the specialized surgical department by the beginning of 4 days. The results of a study carried out according to the multimodal principle showed the efficacy and safety of combined epidural anesthesia with bupivacaine against the background of low-flow anesthesia with sevoflurane and continuous sedation with propofol in children with the indicated abdominal surgical pathology.

5 Conclusions

1. Combined epidural anesthesia with bupivacaine against the background of low-flow anesthesia with sevoflurane with continuous sedation with propofol provides effective and controlled anesthetic protection during abdominal operations for Hirschsprung's and Payr's disease, dolichosigma in children.
2. Logical continuation of EA with bupivacaine in the early postoperative period adequately provides antinociceptive protection in this category of patients, promotes early restoration of intestinal motility and active mobilization of patients.

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