

Multimodal Anesthesia and Analgesia at the Stages of the Perioperative Period in Children with Abdominal Surgical Pathology

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Abstract

Was assessing both the effectiveness and safety of anesthetic management and optimizing postoperative anesthesia under conditions of multimodal anesthesia abdominal operations in children. The authors examined 61 children aged 1 to 14 years with abdominal operations (malformations, diseases, and abdominal organ injuries). To ensure anesthetic protection, patients underwent combined general anesthesia with propofol and fentanyl (induction) with inhalation of sevoflurane + propofol intra venous (maintenance) in combination with epidural blockade with bupivacaine. According to surgical intervention, the arrangement of perioperative analgesic protection provided a favorable correction of the hemodynamic status of patients, a decrease in inhalation anesthetic, promoted a smooth course of the postoperative period, a long painless period, an excellent psychoemotional background, and rapid postoperative recovery.

Keywords: Multimodal Anesthesia and Analgesia; Epidural Anesthesia; Propofol and Fentanyl; Inhalation of Sevoflurane, Abdominal Surgery in Children; Central Hemodynamics; Postoperative Period

Abbreviations

FT: Fast Tracts; MVC: Minute Volume of Blood Circulation; MAP: Mean Arterial Pressure; SV: Stroke Volume; ECG: Echocardiography; SpO₂: Saturation Oxygen; SBP: Mean Diastolic Pressure; DBP: Diastolic Blood Pressure; BP: Arterial Pressure

Introduction

Accelerated Surgery (FT) was first introduced in 1991 for colorectal surgery FT surgery is used to accelerate recovery from evidence-based “unimodal” surgical procedures through the use of a “multimodal effort” model [1-4]. FT surgery combines a variety of perioperative care techniques and regimens that include epidural or regional anesthesia, minimally invasive techniques, optimal pain control, preoperative oral nutrition, and postoperative early locomotion [5,6]. By applying these procedures, rapid tracking can reduce stress responses and organ dysfunction, shorten recovery time, avoid complications, and lower costs [5]. Based on the studied literature [7-9], most of which are presented in adult practice and our own experience, our studies are devoted to the development and implementation of combined general anesthesia with propofol + low-flow anesthesia with sevoflurane + epidural analgesia with bupivacaine in children undergoing abdominal surgery [10-12]. Anesthesiologists as perioperative physicians play a key role in expedited surgery by choosing

preoperative drugs, anesthetics and methods, using prophylactic drugs to minimize side effects [12]. Accelerated therapies are now available for all common procedures in general and visceral surgery [13-15], 14 years after Danish surgeon Henrik Köhlet and his collaborators first published the first clinical accelerated path for patients undergoing elective colon resection [2].

Materials and Methods

Of research prospective study of combined general anesthesia in 61 children operated on at the TashPMI clinic in 2018 - 2021 for Hirschsprung’s disease, dolichosigma, liver echinococcosis, pancreatic cysts, portal hypertension. The average age is 10.2 ± 0.9 years. The functional state of the patients corresponded to: II-III class ASA. Premedication with atropine 0.1%- 0.01 mg/kg, sibazone 0.5%- 0.2 mg/kg, antihistamines were administered as indicated. Induction was started with propofol 1%- 2 - 3 mg/kg, fentanyl 3 µg/kg, arduane 0.08 mg/kg, iv, followed by tracheal intubation and transfer to mechanical ventilation. Sevoflurane - 1 vol% with O₂ 60% (Fabius Plus with capnograph, Drager, Germany). Sevoflurane was gradually increased to 1.5 vol% (low-flow anesthesia). Then, puncture and catheterization of the epidural space were performed, at the (Th10-Th7) level. In the supine position, the patient was administered bupivacaine 0.5%-0.3 - 0.4 mg/kg. Maintenance of anesthesia: propofol 5 - 6 mg/kg/hour. Maintenance of myoplegia: Arduan fractional, on demand. The duration of the operation is 98 ± 10 minutes.

Hemodynamics were assessed using an APLIO 500 “TOSHIBA” (JAPAN) echocardiograph (EchoCG): minute volume of blood circulation (MVC), heart rate, ejection fraction (PI), mean arterial pressure (MAP) and stroke volume (SV). 5 stages of the study: 1- in the preoperative, before premedication, 2- induction of anesthesia; 3- traumatic stage; 4- the end of the operation and awakening, 5- 2 hours after the operation Infusion therapy was performed taking into account blood loss and, accordingly, the indicators of blood pressure, heart rate, CVP, urine output. therapy 5 ml/kg/h (Ringer’s solution). Erythrocyte mass, FFP transfused according to indications. Perioperative monitoring: ECG, blood pressure, SpO₂, sevoflurane using a Nihon monitor Kohden. From the moment of awakening, the intensity of pain was assessed using a 10-point digital rating scale (NRSC) and the recovery of intestinal peristalsis (auscultation) was assessed.

Results

Stage 1 data corresponded to the initial hemodynamic parameters when the patient was admitted to the preoperative ward before premedication. Analysis of hemodynamics showed an increase in SBP, DBP and BP avg at stage 2 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, a relative stabilization of hemodynamics was noted in relation to the previous stage, and in relation to stage 1, SBP, DBP, and BP, cf. remained increased by 12.2% (p < 0.05), 27.1% (p < 0.05) and 16.3% (p < 0.05), respectively. HR, IOC, and SV remained stable at the stages of maintaining anesthesia, increased relative to stage 1 by 7.3% (p > 0.05), 17.7% (p < 0.05) and 26.5% (p < 0.05). At stage 4, 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 they were increased by 5.1%, 13.4% (p < 0,05) and 9.6%. 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.

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

Table 1: Results of the study of hemodynamics at the stages of research.

Note: *: Significant differences in indicators in relation to stage 1 (*P < 0,05; **P < 0,001).

A significant increase in DBP, ABP 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. The absence of statistically significant fluctuations in FI confirmed the absence of a depressive effect on the work of the heart and the provision of the body's need for adequate perfusion under the conditions of this method of anesthetic management. At the 5th stage, 87.9% of children woke up against the background of persisting analgesia due to the epidural block. 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. In 60.3% of patients who underwent abdominal-perineal proctoplasty, prolonged epidural anesthesia with bupivacaine was performed for 3 days.

Discussion

By the end of 3 days, intestinal peristalsis appeared in patients. The stable course of the postoperative period, early mobilization contributed to the transfer of 32.7% of patients to the specialized surgical department by 2 - 3 days. The results of the study, carried out according to the multimodal principle, showed the efficacy and safety of combined general anesthesia consisting of EA bupivacaine against the background of low-flow anesthesia with sevoflurane and continuous sedation with propofol in sick children with abdominal pathology. The logical continuation of EA in the postoperative period adequately provided antinociceptive protection in this category of patients.

Conclusion

1. Multimodal combined general anesthesia, consisting of EA bupivacaine, against the background of low-flow anesthesia with sevoflurane with continuous sedation with propofol, provides reliable and controlled anesthetic protection during abdominal operations in children.
2. The proposed method of reduces the pharmacological load, promotes early awakening, active mobilization, rapid recovery of intestinal motility, a decrease in the period of postoperative recovery, and a reduction in the length of stay in the ICU, which has a good economic effect.

Conflict of Interest

The authors declare no conflict of interest.

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