Pediatric Anesthesia and Critical Care Journal 2020;8(1):39-44
doi:10.14587/paccj.2020.7

PACCJ

Analysis of critical incident identified with different options for anesthetic benfits used in one-day surgery in children

E. M. Nasibova

Department of Anesthesia, Azerbaijan Medcial University, Baku, Azerbaijan

Corresponding author: E. M. Nasibova, Department of Anesthesia, Azerbaijan Medcial University, Baku, Azerbaijan
Email: doc.nasibova.esmira@gmail.com

Keypoints

When performing surgery for a specific disease, the result of the operation, of course, depends on the skill of the surgeon, but the support, correction, and, if necessary, restoration of vital vital functions of the patient's body depends on the professionalism of the anesthesiologist. That is why the concept of patient safety in world medical practice is associated primarily with anesthesiology.

Abstract

Introduction

Optimization of anesthesiology benefits by conducting an internal medical audit based on the registration of critical incidents.

Material and Methods

An internal medical audit was applied to different versions of the anesthesiological aid carried out during surgical interventions in the conditions of one-day surgery. The age of patients ranged from 0 to 16 years. In most cases, operations were performed as planned.

Results

In our study, 498 critical incidents were recorded in patients, so the frequency of critical incidents (CHI) was 0.63 ± 0.03 incidents per operation. When analyzing critical incidents at the stages of various options for anesthesia, we found that their greatest number occurs at the stages of induction anesthesia and in the postoperative period (184 and 139, respectively).

At the stage of maintaining anesthesia, the number of critical incidents is two times less than at the previous stage and does not significantly differ from that at the stage of awakening the patient. The most common critical incident at the stage of induction of anesthesia in children is laryngospasm caused by insufficient depth of anesthesia. Our study results showed that CI associated with the cardiovascular system were recorded at all stages of the anesthesiological aid, including the postoperative period. However, they were more often observed during induction of anesthesia (57) and maintenance of general anesthesia (38). So, all patients of this group, bypassing the wake-up chamber, were immediately transferred to the surgical ward immediately after the operation. Since complete awakening occurred in patients of this group on the operating table and hemodynamic parameters remained stable.

Conclusion

Reasonable inclusion of patients in the fast track group significantly saved their costs operated in the conditions of one-day surgery.

Keywords

Sevoflurane, critical incidents, caudal anesthesia.

Introduction and aim of the study

When performing surgery for a specific disease, the result of the operation, of course, depends on the skill of the surgeon, but the support, correction, and, if necessary, restoration of vital vital functions of the patient's body depends on the professionalism of the anesthesiologist. That is why the concept of patient safety in world medical practice is associated primarily with anesthesiology. In

recent decades, many researchers have come to the conclusion that one of the ways to improve patient safety measures in anesthesiology is to create anesthesia protocols that allow you to choose the best type of anesthetic aid for a particular patient based on the type of underlying pathology, the nature of the proposed surgical intervention, and the patient's initial condition. It is advisable to evaluate the effectiveness of a separate clinical unit according to the principles of internal medical audit, on the basis of the analysis of the data of which it is possible to evaluate its activities, to identify areas necessary for improvement.

The registration of critical incidents during an internal medical audit is important in the course of anesthetic management, it allows us to draw conclusions about the influence of various factors on the incidence of complications in the perioperative period, which makes it possible to predict and prevent them, and ultimately significantly increase patient safety during anesthetic management. A critical incident is understood to mean the situation observed during anesthesia, which, in the absence of timely intervention, can provoke extremely undesirable consequences.

And conducting an internal medical audit based on the registration of critical incidents allows their prevention, and this will lead to increased patient safety. The method of internal anesthesiology audit, based on the recording of critical incidents, is quite deep and varied, and is especially useful for identifying important points in everyday practice (1, 2, 3, 4, 5, 6, 7, 8, 9).

Optimization of anesthesiology benefits by conducting an internal medical audit based on the registration of critical incidents.

Material and Methods

An internal medical audit was applied to different versions of the anesthesiological aid carried out during surgical interventions in the conditions of one-day surgery. The age of patients ranged from 0 to 16 years. In most cases, operations were performed as planned. The following types of anesthesia were used:

Group I (n = 106). In patients of this group, anesthesia and maintenance anesthesia were carried out by inhalation of sevoflurane through a facial mask and a bolus of intravenous fentanyl.

Group II (n = 58). Induction anesthesia in patients of this group was carried out by bolus administration of propofol and fentanyl.

Group III (n = 156). Introduction to anesthesia was carried out by bolus administration of propofol and fentanyl. Tracheal intubation was carried out after the introduction of medium-acting muscle relaxants. Anesthesia was maintained by continuous infusion of propofol with a Perfusor Space Braun pump and bolus administration of fentanyl.

Group IV (n = 159). Induction anesthesia was performed by inhalation of halothane, or sevoflurane, or isoflurane. Depending on the type of airway management, this group was divided into 3 subgroups: IVA group - children with an endotracheal tube (ETT), IVB group - children with a laryngeal mask (LMA), IVC group - with a COPA duct.

V group (n = 278). Induction anesthesia was carried out by bolus administration of propofol. After the patient was completely asleep, a caudal block was administered with the introduction of a local anesthetic (bupivacaine, ropivacaine and ropivacaine + dexamethasone) into the caudal canal.

Group VI (n = 37). Induction anesthesia in patients of this group was carried out by means of an intravenous bolus of ketamine at a dose of 2 mg / kg and midazolam 0.4 mg / kg orally and intravenously with fentanyl.

Results

In our study, 498 critical incidents were recorded in patients, so the frequency of critical incidents (CHI) was 0.63 ± 0.03 incidents per operation. When analyzing critical incidents at the stages of various options for anesthesia, we found that their greatest number occurs at the stages of induction anesthesia and in the postoperative period (184 and 139, respectively). At the stage of maintaining anesthesia, the number of critical incidents is two times less than at the previous stage and does not

significantly differ from that at the stage of awakening the patient. Evaluation of the qualitative composition of CI allowed us to identify the relationship of the main critical incidents with the respiratory system, central nervous system and cardiovascular system (1). As the analysis of the data presented in Table 1 shows, critical incidents related to respiratory disorders are most often encountered during induction of anesthesia and at the stage of maintaining anesthesia (70 and 24, respectively). Practice shows that the most formidable critical incidents are respiratory hypoventilation and critical hypoxemia, which are observed at the stages of induction of anesthesia, associated with inadequate ventilation and in the postoperative period due to untimely extubation of the patient.

Table 1. Qualitative composition of critical incidents depending on the stages of the anesthetic

Critical incidents	Induction anesthesia	Maintaining anesthesia	Awakening	Postoperative period	Total
Bronchospasm	1	-	1	-	2
Laryngospasm	18	3	4	-	25
Hypoventilation (respiratory rate <10)	12	5	3	-	20
Cough	14	5	-	-	19
Critical hypoxemia	7	5	-	-	12
Allergy	8	-	-	-	8
Difficult intubation	3	-	-	-	3
Moderate hypoxemia	18	6	7	2	33
Bradycardia	15	5	-	-	20
Tachycardia	6	10	1	3	20
Arrhythmia	5	-	3	-	8
Arterial hypotension	31	23	5	-	59
Nausea	-	-	20	25	45
Motor excitement	26	2	7	-	35
Long sleep	-	-	-	25	25
Vomiting	-	-	3	21	24
Hallucinations	-	-	10	5	15
Chills and muscle tremors	-	-	27	2	29
Skeletal muscle hypertonia	20	-	3	-	23
Delay in motor activity			-	31	31
Urinary retention	-	-	-	11	11
Diplopia	-	-	4	4	8
Dizziness	-	-	6	3	9
Headache	-	-	-	3	3
Shiver	-	-	5	3	8
Hiccups	-	-	2	1	3
Total	184	64	111	139	498
For 1 patient	0,23±0,02	0,08±0,01	0,14±0,01	0,18±0,01	0,63±0,03

The most common critical incident at the stage of induction of anesthesia in children is laryngospasm caused by insufficient depth of anesthesia. Our study results showed that CI associated with the cardiovascular system were recorded at all stages of the anesthesiological aid, including the postoperative period. However, they were more often observed during induction of anesthesia (57) and maintenance of general anesthesia (38). The greatest number of critical incidents associated with a change in blood pressure, namely arterial hypotension in 31 cases, occurred at the stage of induction anesthesia. Changes in heart rate in the form of tachycardia were noted in 16 cases, and in the form of bradycardia in 20 of the total number of critical incidents related to the cardiovascular system. In the period of induction and maintenance of anesthesia, CI associated with the nervous system in our observations were absent, but were mainly observed in the postoperative period in the form of nausea and vomiting in 45 and 24 patients, respectively. The greatest number of critical incidents in the form of delayed motor activity (31) and urination (11) occurred in patients of group V, where a caudal block was used as anesthesia, without leading to serious complications. Critical incidents in the form of urinary retention and motor activity did not prevent the early discharge of patients, as they were eliminated on their own two hours after anesthesia. A detailed analysis of the material obtained in the study showed that the greatest number of CI associated with CVS and the respiratory system was noted at the stages of induction of anesthesia and maintenance of anesthesia. And we explained this by insufficient depth and adequacy of anesthesia. In our study, not a single critical incident led to the development of serious complications in the form of a fatal outcome. The objective of our study was to assess the applicability of the developed criteria for including patients in the fast track group. During the study, the following criteria were developed for inclusion in this group:

- the patient raises his head, arms, reaches for the hands of staff, is capable of independent action;
- the patient has no pain;
- there are no respiratory and circulatory disorders;
- there is no agitation, anxiety, excessive motor activity, etc.).

The above criteria are based on the Aldrete and Steward scales used to evaluate postoperative awakening. According to these scales, a 5-6 point was considered a satisfactory criterion for transferring the patient to the surgical

ward bypassing the fast track ward. Upon detection of any critical incident, patients were transferred to the wake-up room. The following complications were identified in the wakeup chamber:

1. Moderate hypoxemia (SpO2 - 92-95%) was observed in group I (sevoflurane + fentanyl) (n = 106) in 2 patients (1.9%) IA, in 7 patients (6.6%) IB, and in 9 patients (8.5%) of IC subgroup, and in group II (propofol + fentanyl) (n = 58) in 4 patients (6.9%) IIA, in 5 patients (8.6%) IIB and in 2 patients (3.5%) IIC subgroups. In patients of group V (propofol + caudal block) (n = 278), only 5 patients (1.8%) had moderate hypoxemia, which passed on its own and did not require any correction.
2. Critical hypoxemia (SpO2 <90%) requiring additional ventilation was noted in group II (propofol + fentanyl) (n = 58) in 4 patients (6.9%). IIA, in 5 patients (8.6%) of IIB and in 1 patient (1.7%) of the IIC subgroup. This was explained by an increase in chest rigidity and hypoventilation of the lungs due to an increase in the dose of fentanyl to ensure adequate pain relief. In 2 cases, patients of this group were intubated due to severe hypoxemia. None of the patients of group V (propofol + caudal block) had cases of critical hypoxemia.
3. Persistent hypotension, with a double measurement of blood pressure at intervals of 5 minutes, was recorded in 2 patients (1.9%) of I and 7 patients (12.1%) of group II (propofol + fentanyl) and 16 patients (47.0%) VA, in 12 patients (12.0%) VB and in 13 patients (9.3%) VC subgroups (propofol + caudal block). In our opinion, this is a consequence of the restoration of circulatory autoregulation systems after administration of propofol.
4. Tachycardia was registered in 2 patients (1.9%) of group I (n = 106) and in 12 patients (7.5%) of group IV (n = 159) at the stage of induction and maintenance of anesthesia, which was associated with either insufficient depth anesthesia and inadequate analgesia, or the use of isoflurane.
5. Prolonged awakening or prolonged sleep was observed in 7 (6.6%) of group I, in 8 (13.8%) of group II, in 4 (2.5%) of patients of group IV and 16 (43.2%) of patients of VI (groups).

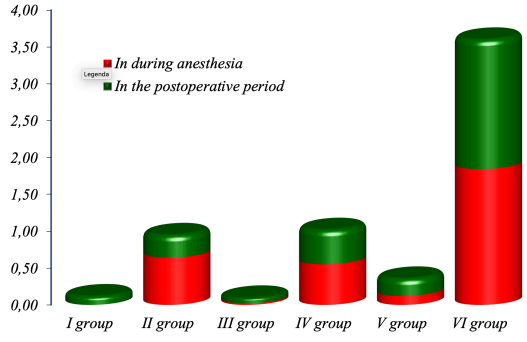
As mentioned above, the number and quality (nature) of critical incidents were one of the main criteria for comparing the discussed methods of anesthesia used in one-day surgery in children. The results of the analysis of critical incidents are presented in table.2 and 3.

The data table. 2 show that in the perioperative period, 33 critical incidents were recorded in group I, of which 60.6% were recorded during anesthesia, and 39.4% in the postoperative period. In group II, 55 critical incidents were recorded, of which 67.3% were observed in the intraoperative and 32.7% in the postoperative period. The increase in the percentage of critical incidents in group II in the intraoperative period (67.3%) compared with group I (60.6%) was explained by a deliberate increase in the dose of fentanyl because pain relief was insufficient (Fig. 1).

Table 2. The number of critical incidents (per 1 patient)

Indicator (quantity)	I Group n = 106	II Group n = 58	III Group n = 156	IV Group n = 159	V Group n = 278	VI Group n = 37
During anesthesia	20 0,19±0,04	37 0,64±0,10	3 0,02±0,01	88 0,55±0,06	32 0,12±0,02	68 1,84±0,22
In the postoperative period	13 0,12±0,03	18 0,31±0,07	13 0,08±0,02	74 0,47±0,05	67 0,24±0,03	65 1,76±0,22
Total	33 0,31±0,05	55 0,95±0,13	16 0,10±0,03	162 1,04±0,08	99 0,36±0,04	133 3,59±0,31

Figure 1. The number of critical incidents in children in research groups (per 1 patient).



And this, in turn, led to an increase in chest rigidity, hypoventilation and the development of critical hypoxemia. The distribution of critical incidents according to

the stages of anesthetic management in patients of groups I and II is presented in Table. 3.

Table 3. Distribution of critical incidents during general anesthesia (for 1 patient)

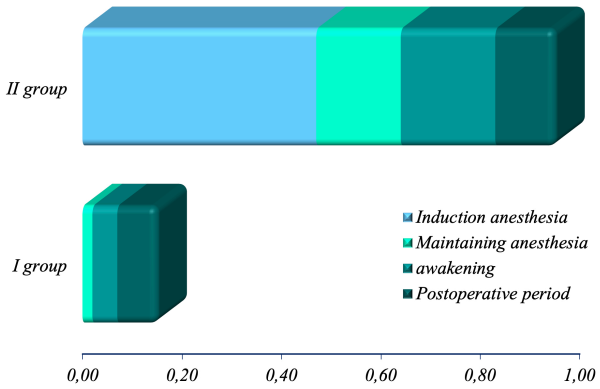
amount critical incidents	I group (sevoflurane + fentanyl) n = 106	II group (propofol + fentanyl) n = 58	χ2; p
Induction anesthesia	18 0,17±0,04	27 0,47±0,09	p<0,001
Maintaining anesthesia	2 0,02±0,01	10 0,17±0,05	p<0,001
Awakening	5 0,05±0,02	11 0,19±0,06	p<0,01
Postoperative period	8 0,08±0,03	7 0,12±0,05	p>0,05
Total	33 0,31±0,05	55 0,95±0,13	p<0,001

Presented in the table 3, the data indicate an unambiguous trend, reflecting a decrease in the number of critical incidents during patient awakening compared with the stages of induction of anesthesia and maintenance of general anesthesia in both studied groups. The same data allow us to conclude that the distribution of critical incidents by stages of general anesthesia between the studied groups did not significantly differ.

One of the important tasks of our study was to determine the number and nature of critical incidents by comparing them in group I (sevoflurane + fentanyl) (n = 106) and in group II (propofol + fentanyl) (n = 58). Analysis of the results showed that in the perioperative period, 55 critical incidents were recorded in patients of group II (propofol + fentanyl), of which 37 were recorded during anesthesia, and 18 in the postoperative period. In group I (sevoflurane + fentanyl) (n = 106) 33 critical incidents were recorded, of which 20 during anesthesia and 13 in the postoperative period. In patients of group II (propofol + fentanyl), critical incidents mainly occurred during the maintenance of anesthesia, which was explained by us by increasing the dose of fentanyl. And in patients of group I (sevoflurane + fentanyl), critical incidents were mainly observed during the induction of anesthesia, which was associated with agitation due to a bolus technique of mask anesthesia with sevoflurane.

Analysis of the qualitative composition of critical incidents depending on the type of anesthesiology aid presented in Fig. 2, showed that there are no significant differences for each specific type of CI, despite a clear tendency to increase them associated with the respiratory system in group II (propofol + fentanyl) compared with group I (sevoflurane + fentanyl). A significantly larger number of CI associated with the nervous system were recorded in the group where sevoflurane was used.

Figure 2. Critical incidents at the stages of general anesthesia.



Among the critical incidents involving the respiratory system, hypoventilation and critical hypoxemia were observed mainly in patients of group II (propofol + fentanyl). Moreover, in patients of group I (sevoflurane + fentanyl), critical hypoxemia is not nabdulas. The main types of critical incidents involving the nervous system were nausea and single vomiting (1 case) and motor excitement (5 cases) observed only in patients of group I (sevoflurane + fentanyl). Only all patients of the V group (propofol + caudal block) were included in the fast track program. So, all patients of this group, bypassing the wake-up chamber, were immediately transferred to the surgical ward immediately after the operation. Since complete awakening occurred in patients of this group on the operating table and hemodynamic parameters remained stable. The fast track group also monitored expected complications. Of course, the monitoring volume in the postoperative ward was much smaller than in the wake-up ward and consisted only of pulse oximetry and non-invasive measurement of blood pressure. In addition, the observation of patients was carried out by a relative who was allowed to be in the ward from the moment the patient was transferred from the operating room. The

nurse monitored the patient's condition 1-2 times during the first two hours and further as necessary. In our study, in the group of patients included in the fast track program, not a single case of the development of hypoxia, hypotension, and bradycardia in the postoperative period was recorded.

Conclusion

Reasonable inclusion of patients in the fast track group significantly saved their costs operated in the conditions of one-day surgery.

References

1. Van der Schaaf TW Medical applications of industrial safety science. Qua! Saf Health Care 2002;11:205-6.
2. Runciman WB, Edmonds MJ, Pradhan M Setting priorities for patient safety. Qual Saf Health Care 2002;11:224-9.
3. Beckmann U, Bohringer C, Carless R, Gillies DM, Runciman WB, Wu Av, et al. Evaluation of two methods for quality improvement in intensive care: facilitated incident monitoring and retrospective medical chart review. Crit Care Med 2003 31:1006-11
4. Maaloe R, Cour M, Hansen A, et al. Scrutinizing incident reporting in anaesthesia : why is an incident perceived as critical? Acta Anaesthesiol Scand 2006;50:1005-1013
5. Braz LG, Modolo NSP and Mascimento P, et al. Perioperative cardiac arrest: a study of 53,718 anaesthetics over 9 years from a Brazilian teaching hospital. Br J Anaesth 2006;95 :569-75.
6. Newland MC, Ellis SJ, Lydiatt CA, et al. Anaesthetic related cardiacarrest and its mortality: a report covering 72,959 anaesthetics over 10 years from a US teaching hospital. Anesthesiology 2002 97:108-15.
7. Sprung J, WamerME, Contreras MG, et al. Predictors of survival following cardiac arrest in patients undergoing non-cardiac surgery: a study of 518,294 patients at a tertiary referral center. Anesthesiology 2003 ;99:259-69.
8. Arbous MS, Grobbee DE, et al. Mortality associated with anaesthesia: A qualitative analysis to identify risk factors. Anaesth200l; 5:1141-1153.
9. Liu EHC and Koh KF. A prospective audit of critical incidents in anaesthesia in a university teaching hospital: AnnAcadMed Singapore 2003;32:814-2