

# A Confidential Questionnaire on Perioperative Critical Incidents as a Tool for Evaluating Anesthesia Safety Problems: a Pilot Study

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## Summary

There is a general agreement on the need to analyze critical incidents in the operating room (OR) in order to develop effective ways to predict associated fatal consequences, as well as to develop decision support cognitive tools that can be used in both routine and crisis situations.

**Research objective.** Developing and testing of a confidential questionnaire on perioperative critical incidents by anaesthesiologists and other intensivists, assessment of the initial results of the tool application including its possible relevance to further implementation in the Russian Federation health care

**Materials and methods.** The survey was conducted by anonymous questioning among doctors of large hospitals in St. Petersburg from 01.06.2024 to 31.12.2024 using an on-line form.

**Results.** Of the 32 questionnaires received, 27 (84.4%) were completed and contained complete information, which was systematized and analyzed. Respondents reported most often on critical incidents in male patients (15 patients, 55.6%), and in the age group of 45–59 years (8 cases, 29.6%). Most of the incidents occurred during minimally invasive video assisted surgery (18 cases, 66.7%). In 14 cases (51.8%), critical incidents were related to human error, and in 9 (33.3%) cases, they were related to unexpected complications in the perioperative period. Most of the respondents (20 out of 27, 74.1%) noted that the incidents could have been prevented with more accurate anesthesia monitoring and relying on more sophisticated and performant anesthetic equipment in the Intensive Care Unit. Doctors positively evaluated the trial version of the anonymous questionnaire (22 out of 27, 81.5%), noting its simplicity and usefulness in identifying problems. Several respondents suggested adding open-ended questions to provide a more detailed description of the incidents.

**Conclusion.** The study confirmed the usefulness of designing and implementing a national questionnaire on perioperative critical incidents in Russia. The data obtained demonstrate that such a tool, combined with improving the staff training, equipment upgrade, and standardization of protocols, can significantly contribute to enhancing patient safety in anesthesia. Ensuring the confidentiality of the provided data is crucial for obtaining statistically significant information. The development, implementation, and expansion of the proposed tool's database under the auspices of the Federation of Anesthesiologists and Resuscitation Specialists on a regular basis will undoubtedly contribute to improving the quality and safety of anesthesiology and resuscitation services in Russia.

## Highlights

— 76.5% of respondents believe that incidents can be prevented by improving anesthesia control and OR anesthetic equipment.

— 81.5% of the surveyed specialists positively assessed the need for implementing the questionnaire, as well as its simplicity and anonymity.

**Keywords:** confidential questionnaire; perioperative critical incidents; anesthesia safety; anesthesia; perioperative period

**Conflict of interest.** The authors declare no conflict of interest.

**Contribution of the authors.** All authors were equally involved in developing the concept of the article, obtaining and analyzing factual data, writing and editing the text of the article, and reviewing and approving the text of the article.

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## Introduction

Modern anesthesiology has made significant progress in ensuring patient safety, but perioperative critical incidents related to anesthesia continue to be a significant concern [1]. These incidents require ongoing analysis and development of new risk management strategies [2, 3]. One key tool in this regard is a national confidential questionnaire on perioperative critical incidents, which can be used to systematically collect and analyze data provided without regard to the «esprit» of particular healthcare professionals and medical organizations, in order to create effective strategies for preventing adverse events [4].

The relevance of introducing such a questionnaire is due to several factors. Firstly, perioperative critical incidents, such as respiratory and hemodynamic disorders, remain the leading causes of anesthesia-related deaths [5]. Secondly, such common risk factors, as surgery in non-working hours and high anesthetic risk according to ASA (American Society of Anesthesiologists) classification, continue to have a significant impact on safety of anesthesia [6–9]. Thirdly, concerns about the institution's reputation and one's own credibility often prevent colleagues from reporting objective information without anonymizing it [6, 10, 11].

It is important to note that despite reduction of anesthesia-related mortality, the main causes of anesthetic incidents remain unchanged [7–9, 12, 13]. This highlights the need for continuous monitoring and analysis of the weaknesses in established protocols, methods, and working practices. A national questionnaire can be an important tool in this process, providing a standardized approach to collecting data on critical incidents.

Regular use of the national questionnaire grants the important advantage of systematic collection of data, which allows for an objective estimate of the rate and nature of perioperative incidents. Further analysis of risk factors helps to identify the main causes of complications and develop measures to prevent them. By using the processed data, it is possible to create effective risk management tools, as well as develop and implement practical protocols and recommendations.

No doubt, the development and implementation of such a questionnaire require coordination at levels of the professional community of anesthesiologists, medical educational institutions, and large and small hospitals.

The aims of the study included developing and testing of a confidential questionnaire on perioperative critical incidents by anesthesiologists and other intensivists, assessment of the initial results of its application, including the relevance of such tool implementation in the Russian Federation health care.

Research objectives:

1. To ensure the confidentiality of data from both the respondents and the patients, in order to

obtain the most reliable and objective data, which would allow anesthesiologists and intensivists to share their experiences without any concerns.

2. Based on the respondents' comments, develop a structured questionnaire that will cover all key aspects of the perioperative period, including patient preparation, choice of anesthesia type and method, anesthesia induction, intraoperative manipulations, and monitoring results, as well as the early postoperative period (up to 24 hours).

3. Analyze all data on the frequency and nature of perioperative critical incidents to identify the main contributing causes and factors.

4. Assess this tool in terms of feasibility and necessity for its further implementation in the Russian Federation.

5. Identify perspectives and obstacles for the widespread implementation of the questionnaire at the national level.

## Materials and Methods

The survey by anonymous questionnaire was conducted in multidisciplinary hospitals in St. Petersburg from June to December 2024 among anesthesiologists and intensivists to comprehensively assess perioperative critical incidents.

Data collection was implemented through the online platform Google forms, which ensured the standardization of the process, the respondents' privacy and the convenience of filling out the questionnaire. Special emphasis was given to ethical aspects, all answers were completely anonymized, personal data of participants and patients were not collected and stored.

A structured questionnaire developed based on a literature review [14–19] and the experience of foreign research groups [4,20] was used as the main data collection tool. The questionnaire consisted of 4 sections covering all key aspects of the perioperative period:

1. Patient preparation: questions regarding preoperative examination, anesthesia risk assessment, and patient preparation for surgery.

2. Choosing anesthesia method: questions about the anesthesia techniques used and their effectiveness.

3. Monitoring during surgery: questions concerning methods of patient's vital functions monitoring and identifying critical incidents.

4. Recovery from anesthesia: questions concerning patient's recovery process and potential complications.

Each section contained clearly formulated questions that allowed for the collection of the most comprehensive information while maintaining the brevity of the questionnaire. Types of questions:

80% — closed-ended (multiple choice, Likert scales);



Fig. 1. QR code for accessing an anonymous questionnaire in GOOGLE Forms.

20% — open (for incident details).

To view the full version of the questionnaire, please use the QR code in Fig. 1.

IBM SPSS Statistics software version 29.0 (IBM Corp., USA) was used for statistical data processing. Categorical variables were described by absolute and relative frequencies ( $N$ , %). Continuous variables were checked for normality of distribution using the Shapiro–Wilk test. Data with a normal distribution were presented as the mean and standard deviation ( $M \pm SD$ ), and non-normal distribution data were presented as the median and interquartile range [ $Me$  ( $Q1$ ;  $Q3$ )]. Fisher's exact test was used to compare categorical variables due to the small expected number of observations in the table cells. Statistical significance of the differences was determined at a  $P < 0.05$ .

A comprehensive statistical analysis was used to process the data, including assessment of the occurrence rate of various types of incidents, identification of significant correlations between different factors and incidents, and a comparative analysis with international indicators of anesthesia safety (comparing the data obtained with the results of international studies on trends in anesthesia-related mortality).

**Table 1. Demographic and clinical characteristics of patients experiencing critical incidents,  $N = 27$ .**

| Parameters                                    | Occurrence rate of critical incidents, $N$ (%) |
|-----------------------------------------------|------------------------------------------------|
| Age, years                                    |                                                |
| Young, 18–44                                  | 7 (25.9)                                       |
| Average, 45–59                                | 8 (29.6)                                       |
| Elderly, 60–74                                | 8 (29.6)                                       |
| Senile, 75 and more                           | 4 (14.8)                                       |
| Gender                                        |                                                |
| Males                                         | 15 (55.6)                                      |
| Females                                       | 12 (44.4)                                      |
| Minimally invasive video-assisted procedures* | 18 (66.7)                                      |
| Assessment on the ASA scale **, classes       |                                                |
| I                                             | 5 (18.5)                                       |
| II                                            | 13 (48.1)                                      |
| III                                           | 7 (25.9)                                       |
| IV                                            | 2 (7.4)                                        |

**Note.** \* — the highest number of incidents was recorded during minimally invasive video-assisted procedures. \*\* — preoperative assessment of patient's physical status according to the ASA classification (American Society of Anesthesiologists).

## Results

A total of 32 questionnaires were received. The following data necessary for classification of the incident were used as the inclusion criteria for the analysis: determining the nature of the incident, the period of its occurrence, and establishing the main cause. Questionnaires that lacked this essential information ( $N = 5$ ) were excluded from the analysis. Therefore, the study included 27 questionnaires (84.4%) that contained complete data suitable for systematization.

The characteristics of patients who experienced critical incidents are presented in Table 1.

Common concomitant diseases are presented in Fig. 2.

**Characteristics of the respondents.** The majority of the respondents (24 specialists, 88.9%) had more than 3 years of work experience, which indicates the qualification and experience of the anesthesiologist.

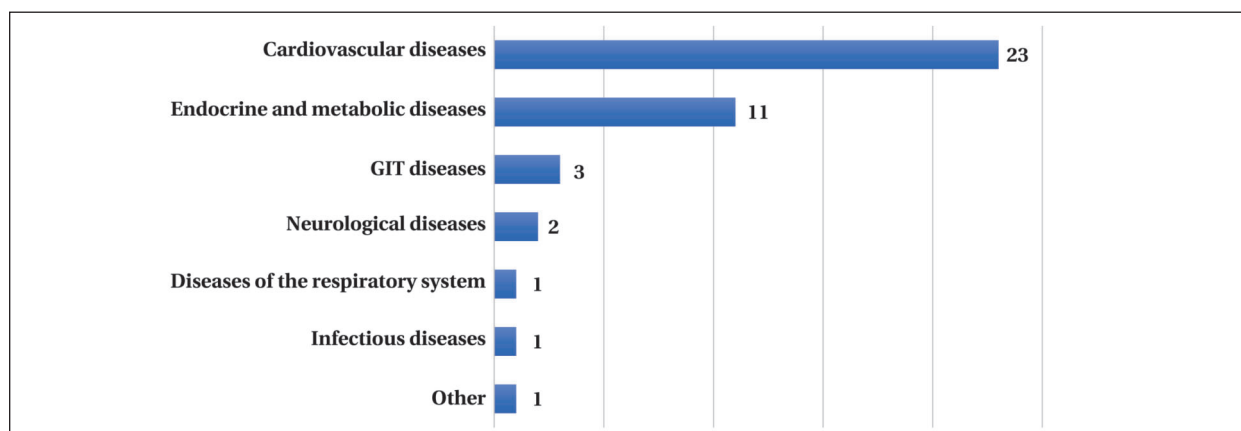
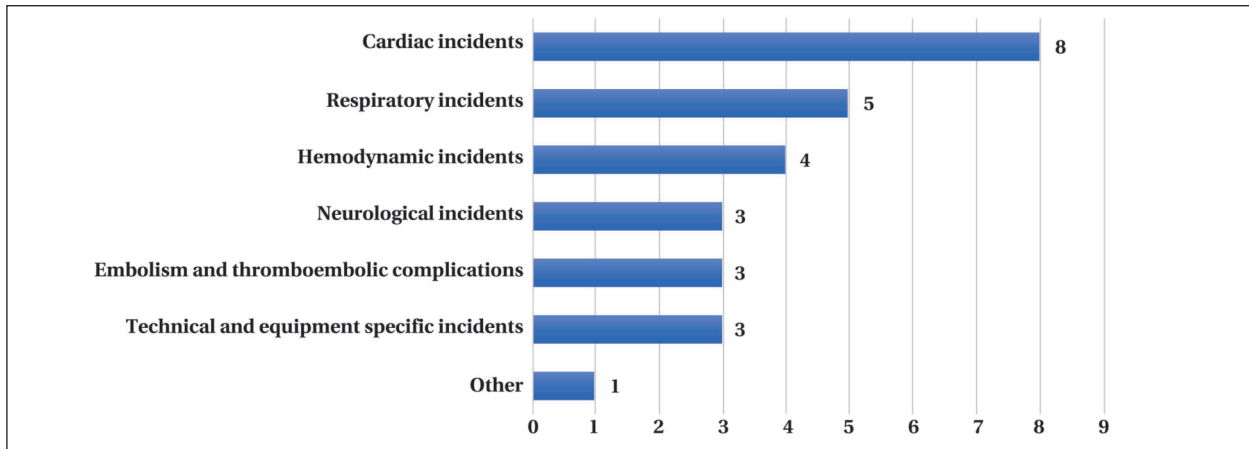


Fig. 2. Incidence of concomitant diseases in patients with critical incidents in the perioperative period.

**Table 2. Perioperative critical incidents.**

| Incident Group                            | Specific events                                                                                                       |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Cardiac hemodynamic                       | Cardiac: cardiac arrhythmias, acute myocardial infarction (AMI), acute coronary syndrome (ACS)                        |
| Respiratory incidents                     | Bronchospasm, aspiration of gastric contents, difficult tracheal intubation, pneumothorax, hemo-pneumothorax          |
| Non-cardiac hemodynamic                   | Hemodynamic: anaphylactic shock, hemorrhagic shock, massive blood loss                                                |
| Neurological                              | High spinal block, transient ischemic attack, acute hemorrhagic cerebrovascular accident                              |
| Embolism and thromboembolic complications | Pulmonary thromboembolism (PTE), amniotic fluid embolism, and fat embolism                                            |
| Technical and equipment specific          | Gas line connection errors, respiratory circuit disconnection, and tracheal mucosal damage during tracheal intubation |
| Other                                     | Malignant hyperthermia                                                                                                |

**Fig. 3. Occurrence rate of critical incidents.**

In 21 cases (77.8%), assistance from more experienced colleagues was available and provided.

The majority of respondents (20 people, 74.1%) worked in national-level hospitals, while the remaining 7 people (25.9%) worked in urban and regional medical facilities.

**Occurrence rate of critical incidents.** Data analysis showed that each of the respondents encountered with critical incidents in the perioperative period at least 2 times during their entire work experience. Fig. 3 shows the frequency of critical incidents in the analyzed data from the respondents.

Table 2 shows the distribution of events by category.

Meanwhile, 22 (81.5%) of the respondents noted that the incidents occurred during scheduled operations in the daytime (8:00–17:00), despite the fact that the patients and teams were prepared and all the risks seemed to have been taken into account.

**Causes of incidents.** According to the respondents, the main causes of critical incidents were:

1. Human error — 14 cases (51.8%), which includes: insufficient preoperative diagnostic elaboration and preparation, incorrect tactical decisions, errors in drug dosage calculation, incorrect interpretation of monitoring data, and medical mal-

practice during manipulations, including manipulations in an unequipped area.

2. Unanticipated challenges emerging during the procedure and not related to a medical error — 9 observations (33.3%), such as amniotic fluid embolism, thrombosis during joint replacement surgery, allergic reactions (to previously unestablished allergen), individual body characteristics and functional body reserves.

3. Equipment shortage — 2 cases (7.4% of cases), such as lack of modern diagnostic equipment, malfunction of anesthetic equipment (including a defibrillator), and disruption of the gas line connection.

4. Organizational issues — 2 observations (7.4% of cases), such as scheduling of overcrowded operating rooms and lack of time to adequately prepare for surgery, and the absence of a blood transfusion unit in the hospital.

At the same time, 20 (74.1%) respondents remarked that many incidents could have been avoided with more stringent monitoring throughout the conduct of anesthesia, sufficient anesthetist's experience, or the opportunity to rely on a more experienced colleague, more advanced facilities and equipment.

**Evaluation of the questionnaire.** The questionnaire was positively evaluated by 22 (81.5%) of

the respondents. They rated it as a high-quality tool for collecting data on critical incidents. They also noted its simplicity, anonymity, and its potential to identify key problems in the perioperative period. However, 8 (29.6%) of the doctors who completed the questionnaire indicated the need for further improvement of the questionnaire, particularly in terms of improving its intuitive clarity and precluding the possibility to dissimulate certain categories of questions when selecting a specific type of anesthesia.

The majority of the surveyed specialists (22 out of 27, 81.5%) positively assessed the need to implement the questionnaire, taking into account legal norms and law enforcement practices, on a regular basis in the Russian Federation, which would undoubtedly contribute to further improving the quality and safety of anesthesiological and intensive care through the analysis and publication of key factors leading to incidents, and systemic recommendations for their prevention.

## Discussion

Systematic data collection on critical incidents using specialized questionnaires is an important tool for analyzing the causes of these incidents and developing preventive measures [12–14].

Analysis of the data revealed that critical incidents, including hypotension, hypovolemia, cardiac arrhythmias, circulatory arrest, hypoxia, and anaphylactic reactions, remain common, which is consistent with the results of international studies [9–17]. It is noteworthy that such incidents occur with equal frequency in patients of various age groups and are not always associated with severe concomitant pathologies, although the latter certainly worsen the prognosis.

Special attention should be paid to high frequency of critical incidents during video-assisted minimally invasive procedures (66.7%). This may be due to the specific conditions of such interventions, in particular, the need to reduce illumination in the operating room to improve visualization on the monitors. Such working conditions create additional difficulties, causing greater stress for the entire operating team, contribute to faster onset of fatigue and reduced concentration. Consequently, this increases the risk of various faults and flaws during both the surgery and the anesthesia, from technical equipment malfunctions to intraoperative complications.

According to the survey, other main causes of critical incidents include the human factor (51.8%) and unexpected perioperative events (33.3%). These results are consistent with findings from other studies, where the human factor and inadequate medical staff training are also leading causes of complications [1, 17–21]. Although organizational issues and inadequate equipment

were mentioned less frequently, they still play a significant role, especially in resource-constrained settings [18].

The majority of respondents positively evaluated the proposed questionnaire, noting its advantages, such as ease of completion and guaranteed anonymity. However, the study participants emphasized the need for further improvement, particularly the inclusion of open-ended questions to provide a more detailed description of the incidents. This recommendation aligns with the findings of other studies aimed at enhancing data collection tools in healthcare [23]. Additionally, the incomplete submission of data in 15.6% of the questionnaires highlights the need for further refinement of the questionnaire structure and heightened motivation for respondents to provide more detailed information.

Refining the questionnaire based on the respondents' comments will make it more user-friendly and provide accurate and informative data about critical incidents, which will ultimately lead to the development of effective measures to improve the safety of anesthesia and surgical procedures in general.

When interpreting the results of this study, a number of limitations should be taken into account. The main limitation is the small sample size ( $N=27$ ), which does not allow for a comprehensive multivariate statistical analysis to identify all significant relationships, and makes it impossible to statistically validate the questionnaire. The results are preliminary and descriptive in nature. Additionally, an important limitation is the lack of a formal assessment of the questionnaire's psychometric properties, such as reliability (internal consistency) and validity. This tool is designed to collect factual and categorical data on incidents and does not contain internal scales for which the Cronbach's alpha coefficient is typically calculated. The validation of such reporting tools focuses on content validity (the completeness of coverage of key aspects of the incident) and practical applicability, which was evaluated in this pilot study through feedback from respondents.

To successfully implement the questionnaire at the national level, it is necessary to undertake a series of actions. First of all, it is required to develop unified standards for data collection and analysis under the auspices of the Federation of anesthesiologists and intensivists. It is equally important to organize regular training for medical personnel aimed at minimizing errors related to the human factor [24]. Improving the basic infrastructure of medical facilities, especially in the context of providing emergency surgical care, also plays a significant role [24–26].

The use of anonymous questionnaires is an essential tool for ensuring security of healthcare

professionals when reporting incidents. In different legal systems, this methodology allows for the avoidance of criminal prosecution in countries where medical errors are criminalized, while also protecting against potential reputational risks and civil law consequences in countries with more liberal legislation. This approach creates the necessary conditions for open professional dialogue, facilitating the identification of systemic issues in healthcare without fear of legal consequences for participants [6, 10, 11, 21].

Sample expansion by including data from various regions of the Russian Federation looks like a promising area for further research. This will provide a representative picture and upgraded database for analyzing the accumulated information, along with identifying potential regional differences and developing preventive measures. This approach not only reduces the frequency of complications, but also promotes a safety culture that meets international WHO standards [25–27].

It is equally important to organize long-term monitoring of critical incidents using an improved questionnaire, as this approach allows for an objective assessment of the effectiveness of implemented preventive measures and tracking of changes over time. The systematic collection and comprehensive analysis of data on perioperative critical incidents contributes to improving patient safety

and reducing the incidence of complications associated with anesthesia and surgical interventions.

Support for the development, testing, and validation of a national confidential questionnaire by the Russian Federation of anesthesiologists and intensivists could bring it closer to clinical practice.

## Conclusion

The conducted study confirms the relevance of the developed questionnaire as a starting point for developing a promising tool for monitoring perioperative critical incidents. Despite the limited sample size ( $N=27$ ), the obtained data revealed important patterns.

It is crucial to identify the prevalence of preventable incidents related to human factors and technical aspects of medical care.

The willingness of the medical community to openly discuss critical situations is particularly valuable, as evidenced by the high percentage of respondents (22/27, 81.5%) who positively evaluated the anonymous survey format. To enhance the information content of the tool, it is advisable to include open-ended questions that allow for a more detailed analysis of the incident circumstances.

In this regard, despite the pilot nature of the study, the results obtained confirm the need to improve the questionnaire on a larger sample with multi-center participation of respondents.

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