UDC 616-089.5-036.7-06

DOI: 10.32471/umj.1680-3051.273106

Anesthetic error. Part 3 (review)

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Abstract. Failure to perform checks, inattentiveness, lack of vigilance, and carelessness have been identified as causative factors for medical errors. In an era where patient knowledge and awareness of diseases and their treatments are expanding, clinicians need to be more vigilant to avoid tragic outcomes and litigation. ***Evidence of obtaining information.*** A retrospective information search of literary sources was performed using a spatial-vector model of a descriptor system based on classifiers, supplemented by a manual search of scientific publications. ***Materials and methods.*** Scientific literature information was obtained using the Scopus, CrossRef, Google Scholar, and PubMed search engines, supplemented by a manual search of cited articles. ***Evidence synthesis.*** The World Health Organization considers diagnostic errors (DE) to be one of the five leading causes of patient safety violations worldwide. In the practice of anesthesiology and intensive care, DEs occur at different stages of the diagnostic process: during the initial assessment and physical examination, during the selection and interpretation of diagnostic tests, or during follow-up and monitoring. For many reasons, diagnosis in primary care (i.e., at first contact, accessible, continuous, comprehensive, and coordinated health care) represents an area of high risk for error. DEs include delayed, incorrect, and missed diagnosis. Diagnostic errors can result in harm through omissions (e.g., delaying or failing to treat an undiagnosed condition) and/or actions (e.g., treating an incorrectly diagnosed condition). Epidemiological data indicate that «classic» complications (failure or airway management error) have become less common. Not using alternative airway management methods was recognized as poor practice, a reminder of the importance of training to become expert in complex airway management guidelines. Airway modeling during tracheal intubation training engages staff of all grades, improves skill retention, and can highlight hidden errors and poor processes. The consequences of equipment failure during anesthesia can be extremely serious. Anesthesia machines have evolved to the point where it takes multiple simultaneous errors to cause harm to a patient. Simple vigilance, standardized protocol, and «think before you act» are key factors in avoiding treatment errors. ***Conclusion.*** Currently, anesthesia error remains an urgent problem of modern medicine. An anesthesia error can be directly related to the human factor, but can also depend on objective reasons. Most anesthesia errors are preventable.

Keywords: anesthesia error, diagnostic error, technical anesthesia error, equipment error.

Introduction

Approximately 40.8 million surgical procedures requiring anesthesia are performed in the United States each year, resulting in approximately 2 million medical errors annually, and an estimated annual healthcare cost of $5.6 billion in the United States alone [1]. In a recent multicenter study, the incidence of major and minor accidents was 0.14% or 1 accident per 694 observations. Another retrospective analysis, published in 1990, included over 113,000 accident reports over a 10-year period. Again, failure to check, inattention, lack of vigilance, and carelessness were identified as causal factors for medical errors (MEs). While the most common problem was dental damage (26%), 19% of reports involved cardiac arrest, of which 16 were fatal. In an era where patients' knowledge and awareness about diseases and their treatments are expanding, clinicians need to be more vigilant to avoid unfortunate outcomes and lawsuits [2, 3].

Evidence of information retrieval

Literature sources were selected for inclusion in the study if they:

- were published in Ukrainian and English,
- reported on anesthetic errors,
- reported on the epidemiology and complications of anesthetic diagnostic errors,
- reported on the cause and consequences of anesthetic equipment errors,
- used an observational study design (cross-sectional or cohort).

An informational retrospective search of literary sources was performed using a spatial-vector model of a descriptor system based on classifiers, which was supplemented by a manual search of scientific publications.

Materials and methods

Obtaining scientific literature information was performed using the information search systems Scopus, CrossRef, Google Scholar, and PubMed and supplemented by a manual search of the articles used using the terms: medical error, anesthetic error, diagnostic error, technical error. 54 relevant scientific sources were analyzed, 87% of which were published in the last 10 years.

Evidence synthesis

Diagnostic Errors

The Institute of Medicine (IOM) defines diagnostic error as the failure to provide an accurate or timely explanation for a patient's health problem(s) or to effectively communicate the explanation to the patient [4]. The World Health Organization (WHO) considers diagnostic errors (DE) to be one of the five leading causes of patient safety violations. A meta-analysis estimated that nearly 250,000 diagnostic errors occur annually among hospitalized adults in the United States, resulting in patient harm [5]. In hospitals in England and Wales, 2288 (42%) ME events were identified from 2013 to 2015, including 315 (14%) misdiagnoses and 1973 (86%) delayed diagnoses [6]. In Australia, approximately 140,000 diagnostic errors occur annually, of which 21,000 resulted in serious harm and 2000–4000 deaths [7].

More than 80% of diagnostic errors are preventable. Cognitive factors in physician decision-making are the primary or indirect causes of more than 75% of diagnostic errors, with systemic errors (e.g., missed communication or laboratory test result follow-up) occurring less frequently. The primary causative factors of DE are failure to formulate an adequate differential diagnosis or overconfidence in incorrect diagnoses. The clinical culture discourages disclosure of diagnostic errors, and they are largely neglected in professional training programs and organizational quality and safety programs [7]. For many reasons, diagnosis in primary care (i.e., at first contact, accessible, continuous, comprehensive, and coordinated health care) represents an area of high risk for error. DEs include delayed, incorrect, and missed diagnosis [8]. Diagnostic errors can result in harm through omissions (e.g., delaying or failing to treat an undiagnosed condition) and/or actions (e.g., treating an incorrectly diagnosed condition) [9, 10]. Among patients in the emergency department of a major hospital presenting with cardiovascular or cerebrovascular/neurological symptoms, delay in diagnosis or denial of admission may have the greatest impact on adverse outcomes [11].

Intuitive thinking is a better way of reasoning, using heuristics (i.e. mental shortcuts or rules of thumb) to speed up the process by limiting the load on short-term working memory to no more than seven ideas at a time. Despite their effectiveness and accuracy in many situations, heuristics can be misapplied due to cognitive biases. Emotions, fatigue, distractions, the opinions of others, and cultural norms can also further impair cognitive accuracy [7, 12]. Metacognition involves clinicians reflecting on their thinking and reflections about past diagnoses and using heuristics accordingly. In some studies, reflection using prompts and modeling improves diagnostic accuracy compared to more general free-flowing reflection. Such strategies, combined with reflection on identified errors («cognitive autopsies»), improve diagnostic efficiency [7, 13]. For example, verifying patient identification, obtaining informed consent, checking the correct side and body area, and final radiologist review have reduced the rate of diagnostic errors from 0.03% to 0.005% [14]. Regulatory and accrediting organizations focus primarily on patient care and management rather than diagnosis. There is a need for external motivators to accelerate progress in diagnostic safety in healthcare organizations [5].

Errors associated with unpleasant respiratory events

When adverse respiratory events occur, three mechanisms of injury are possible in 75% of cases: improper ventilation of the lungs (38%), esophageal intubation (18%), and difficult tracheal intubation (17%) — according to a study of medical claims [16]. A delay of just a few minutes in establishing a patent airway can cause hypoxic brain damage or death, and a medical error during endotracheal intubation can lead to catastrophic complications [17, 18].

Epidemiological data indicate that «classic» complications (failure or error in airway management) have become less common [19]. There are several causes of cardiac arrest during anesthesia, with airway-related catastrophes accounting for up to 50% of anesthesia-related deaths [20, 21].

Difficult airways are characterized by a clinical situation in which a sufficiently trained anesthesiologist has difficulty with mask ventilation, tracheal intubation, or both.

Difficult ventilation is a clinical situation where the anesthesiologist can not maintain SpO_2 >90% at FiO2 = 1.0 in a patient with an initial SpO_2 >90%.

Difficult laryngoscopy — the inability to visualize the vocal cords during optimal direct laryngoscopy.

Difficult tracheal intubation is a clinical situation in which the anesthesiologist needs more than 2–3 attempts of standard laryngoscopy or more than 5–10 minutes to achieve correct endotracheal tube (ETT) placement. This situation can be expected or unexpected (when no prediction is made or an emergency situation) [22].

Difficult tracheal intubation is defined as «the inability of an experienced anesthesiologist to visualize any area of the glottis after repeated attempts at direct laryngoscopy». The incidence of difficult laryngoscopy is as high as 8%. The frequency of difficult intubation in general is 1:100 intubations, failed intubation — 1:2000. In the structure of anesthetic mortality, mortality associated with difficult tracheal intubation is 30%, and the frequency of cases of «impossibility of neither intubation nor ventilation» ranges from 0.01 to 2 cases per 10,000 intubations. To perfect the skill of successful tracheal intubation, it is necessary to perform at least 20 difficult intubations.

Failed tracheal intubation is the inability to place an ETT in the trachea after multiple attempts at intubation [22]. Repeated tracheal intubation increases the risk of circulatory arrest by 0.7–11% [23].

Tracheal intubation errors:

- Unpredictable single-lung intubation (threat of lung atelectasis).
- Too superficial position of the ETT (ETT cuff in the glottis: induction of vagus nerve reflexes, potential injury to the vocal cords).
- Overinflation of the ETT cuff (cuff rupture or cuff herniation with occlusion of the ETT lumen on expiration: overdistension of the lungs).
- ETT inflection (hypoxia).

Risk factors for difficult tracheal intubation include:

- Positive Patil test: thyromental distance is defined as the distance between the chin and the thyroid cartilage. Normally it is ≥6.5 cm, a high risk of difficult intubation is assumed if it is less.
- The distance between the upper and lower incisors is normally ≥4 cm, a high risk of difficult intubation is expected if it is smaller.
- Mallampatti and Cormac — Lechana class III–IV are associated with a high risk of difficult tracheal intubation [22].
- MACOCHA score (Table).

Table MACOCHA score*

Factors	Points
Patient-related factors	
Mallampatti Score III–IV	5
Obstructive sleep apnoea syndrome	2
Redused mobility of the cervical spine (C)	1
Limited mouth opening <4 cm	1
Pathology-associated factors	
Coma	1
Severe hypoxemia (SpO_2 <80%)	1
Operator-related factor	
Non anesthesiologist	1

*A MACOCHA score ≥3 indicates difficulty in intubation in critically ill patients. The degree of cardiorespiratory compromise should be considered, as optimizing hemodynamics before induction improves outcome [24].

Step-by-step actions:

- Giving a «sniffing pose».
- Monitoring should include oximetry, capnography, blood pressure, heart rate, ECG, and, if possible, end-tidal oxygen concentration.
- Preoxygenation. If standard nasal cannulas are used, they should be used during preoxygenation with a flow

of 5 L/min while awake, increasing to 15 L/min when the patient becomes unconscious. It is recommended to use 5–10 cm H2O CPAP if oxygenation is compromised.
- Selection of a rapid-acting neuromuscular blocker (NMBA), precautions against pulmonary aspiration.
- Sellick's maneuver — with a pressing force of 1 kg while awake, increasing it to 3 kg after loss of consciousness.
- Waveform capnography must be used to confirm successful intubation. The absence of a recognizable waveform indicates failed intubation unless proven otherwise.

Although the vast majority of esophageal intubation errors are recognized immediately, nearly 4% of these errors are verified with delay. Unrecognized or late-diagnosed esophageal intubation can lead to very serious complications, including critical hypoxemia, aspiration, anoxic brain injury, cardiac arrest, and death. Delayed recognition of esophageal intubation was associated with a more than 5-fold increase in critical hypoxemia, a 16-fold increase in the risk of aspiration, and a 14-fold increase in the incidence of periintubation cardiac arrest [17, 25]. Routine use of a video laryngoscope (VL) helps reduce the incidence of esophageal intubations. After intubation, the team should ensure that a capnogram demonstrating exhaled CO_2 is available to confirm that the tube is correctly positioned in the airway. Because esophageal intubation is not necessarily associated with a perfectly flat CO_2 footprint, the concept of «sustained CO_2 clearance» was developed to clearly define what constitutes a minimally adequate CO_2 footprint to preclude esophageal intubation. A sustained exhaled CO_2 is a confirmation of correct ETT position [25]. The use of a flexible endoscope to identify tracheal rings can also be used to visually confirm tube placement, although this may take an unacceptable amount of time if the equipment is not immediately available or the clinician is unfamiliar with it. Another viable method of ruling out esophageal placement of an ETT is to use a point ultrasound of the anterior neck. If the tube is in the esophagus, a «double tract sign» may be seen, which is an echogenic shadow seen laterally of the trachea and caused by the presence of the tube in the esophagus. Chest radiography, although useful in determining the position of the tube in the airway, cannot be used to rule out esophageal intubation. On a single-view anteroposterior portable chest radiograph, the tube may be in the esophagus but may appear to be in the anterior trachea [17, 26].

The «vortex approach» to airway crisis management emphasizes the importance of avoiding repeated attempts at tracheal intubation with the same technique when difficulties arise. A maximum of three attempts at oxygenation via a suprapharyngeal airway device, mask ventilation, or tracheal intubation are allowed, with a fourth attempt possible with the involvement of an airway expert. Failure of all attempts or clinical deterioration requires transition to a more sophisticated airway protection algorithm [24], which is implemented through the following steps:

1. The choice of airway strategy and technique should be based on previous experience; available resources, including equipment, availability and competence of care; and the context in which airway management will occur.

2. Low or high flow nasal cannula, elevated head position during procedure, noninvasive ventilation during preoxygenation.

3. Awake intubation techniques include flexible bronchoscope, video laryngoscopy, direct laryngoscopy, combined techniques, and retrograde wire intubation.

4. Other options include, but are not limited to, alternative awakening techniques, planned awake airway invasion, alternative anesthesia techniques, induction of anesthesia (if unstable or cannot be postponed) with preparation for emergency airway invasion, and deferral of the case without attempting the above options.

5. Invasive airway techniques include surgical and needle cricothyrotomy, large-cannula cricothyrotomy, or surgical tracheostomy. Elective invasive airway techniques include above-the-line and retrograde guidewire intubation, and percutaneous tracheostomy. Also consider rigid bronchoscopy and ECMO.

6. Consideration of the size, design, location, and suprapharyngeal breathing devices of first-generation versus second-generation may improve ventilation capacity.

7. Alternative complex intubation approaches include (but are not limited to) video laryngoscopy, alternative laryngoscope blades, combined techniques, supraglottic airway intubation (with or without flexible bronchoscopic guidance), flexible bronchoscopy, and a lighted introducer and stylet. Aids that may be used during intubation attempts include tracheal tube introducers, rigid intubation stylets, or tube exchange devices and external laryngeal manipulation.

8. Postponement of the case or postponement of intubation and return with appropriate resources (staff, equipment, patient preparation, awake intubation).

9. Other options include, but are not limited to, continuing the procedure using a face mask or suprapharyngeal airway ventilation. Choosing these options generally means that ventilation will not be problematic [23, 27].

Failure to use alternative airway management techniques has been recognized as poor practice, a reminder of the importance of training to become expert in complex airway management guidelines [28]. Airway modeling during tracheal intubation training engages staff of all grades, improves skill retention, and can highlight hidden errors and poor processes [24].

The consequences of equipment errors in anesthesia can be severe [29]. Anesthesia machines have evolved to the point where multiple simultaneous errors are required to cause harm to the patient [30].

When working with anesthesia equipment, human errors cause the vast majority (80–82%) of adverse events during anesthesia, and technical failure — in only 14%. An example of a latent error is a malfunction of an artificial lung ventilation device. However, the neglect of the clinician to check the device before use is an active error. An important role in equipment errors is played by insufficient familiarity with the equipment or devices (9.3%) [31–34] and overreliance on middle and junior staff (15.6%) [32]. Equipment errors can include not only malfunction of the equipment itself, but also some other errors that occur when the physician in an unfamiliar environment is faced with new or non-standard equipment (10%) [23, 35].

The incidence of equipment errors was 0.23% during general anesthesia and 0.05% during regional anesthesia. Anesthesia errors related to anesthesia and respiratory equipment account for 31.2% of all equipment errors [35]. Equipment failure is defined as an unexpected malfunction of a device despite regular maintenance and previous error-free use. Provider error was defined as an error or human error related to the preparation, maintenance, or deployment of a device [16]. The majority (85%) of medical error reports involved the provider (16.5%) with or without (68.5%) equipment failure, and 35–37% of these were considered preventable by careful pre-anesthesia equipment inspection [16, 35].

In the United States, a closed claims project found that adverse outcomes from gas delivery equipment failure resulted in death or irreversible brain damage in 76% of cases [35].

Researchers in Australia have shown that suboptimal design (insufficient font size and display readability) of anesthesia equipment, infusion pumps, or interchangeable tubing connectors can interfere with the anesthesiologist and can lead to errors.

In 2010, the entire batch of «LEON» anesthesia machines that arrived in Ukraine was underequipped with expensive analyzers for the concentration of anesthetic gases in the respiratory circuit, which immediately raised doubts about the safety of anesthesia. BIS monitors, which could partially eliminate the problem, were almost non-existent at that time due to their high cost. Thus, a complex legal conflict occurred, when the legally prescribed obligation of recipients conflicted with the fact of the impossibility of ensuring the proper quality and safety of general anesthesia due to the incomplete equipment of anesthesia and breathing apparatus [36].

The most common device associated with inhalation errors was the vaporizer. When used correctly, universal end-tidal monitoring of agents should reduce these errors, although this requires frequent review of the end-tidal volatile agent concentration and activation of appropriate alarms, noting that most monitors default to a low alarm [35].

Nitrous oxide is not currently used in Ukraine, but the authors retrospectively participated in two forensic medical examinations of patient deaths resulting from double breakdowns of «Narcon-P» devices, which resulted in the activation of the oxygen rotameter under nitrous oxide pressure after an emergency shutdown of the centralized oxygen supply. Reports from Swiss clinicians prove that 6 of the 70–100 anesthesia-related deaths were probably caused by unintentional ventilation of the lungs with excessive concentrations of nitrous oxide. This also applies to the use of universal gas connectors, which does not exclude errors in connecting medical gases [20]. The main factors that reduce the risk of such errors by 38% are re-inspection of equipment (especially after repair or maintenance) and detection by monitoring equipment by 33% [20, 35].

Among the prevention standards are mechanical interlocking between the controls of oxygen and nitrous oxide flow meters, a fail-safe mechanism that can warn of a disconnection in the event of a failure of the oxygen supply line. Indexing of medical gas pins should avoid incorrect connection during daily use. The only technical mechanism to detect improperly connected hoses and nitrous oxide escaping from the oxygen pipeline may be an oxygen analyzer. According to European standards (EN 740), oxygen analyzers must be built into all anesthesia machines, and according to the standards of the American Society of Anaesthesiologists (ASA) and the Association of Anaesthesiologists of Great Britain and Ireland (AAGBI), the anesthetic should not be used without them. Careful preoxygenation of each patient can make them an indirect controller of their anesthesia machine. Increased oxygen saturation at high FiO_2 indicates that the anesthesia machine is working properly. Conversely, a drop in oxygen saturation during preoxygenation may indicate the administration of a hypoxic gas mixture [20]. Major shortcomings that led to incidents and errors have been addressed by technology and engineering, such as the use of connectors that connect only in the required sequence, continuous capnography and pulse oximetry, etc. [37].

Critical incident — any situation that has affected or is capable of affecting patient safety regardless of time. Currently, a critical incident in medicine is generally understood to mean an event that can lead to an adverse outcome directly, or to be interpreted as «...human error or equipment malfunction, which, if not recognized and corrected in a timely manner, could lead to or has led to adverse consequences ranging from prolonged hospital stay (in the recovery room, intensive care unit) to death». A critical incident is a problem that will not resolve on its own, will develop and may lead to a serious complication or death of the patient [38].

A review of the issue of anesthetic patient safety has shown that half of anesthesia-related deaths could be avoided through the widespread use of vital signs monitoring [38]. Thus, if a difficult intubation is reported and the patient later dies, pulse oximetry and capnography data can provide evidence that oxygenation and ventilation were maintained throughout. In the previous era, it could be assumed that such cases were related to anesthesia, even though there may not have been a physiological connection [39].

Discussion of the results

The rate of errors in anesthesiology has decreased over the past few decades, such that perioperative mortality averages 1 per 100,000 anesthesias, but the cost of medical negligence claims has increased by 30% [40]. Over the past 20 years, reducing ME has been an active area of research in anesthesia. Many reports have demonstrated a median (range) reduction in errors of 39%, as required by the WHO Global Patient Safety Action Plan [41, 42].

The WHO «Safe Medicines Initiative» has a vision of reducing harm caused by medication errors by 50%. To achieve this, it is important to know the current level of MA [43].

The level of incident reporting and error detection currently falls short of the standards that would be expected in an open and safety-oriented environment [44]. The contribution of anesthesia and critical care to the global problem of medical errors is far from understood and very difficult to study. Efforts to do this have typically relied on case reporting and a single-practice approach in the face of funding constraints [29]. Most current recommendations focus on proactive error and neglect underlying causes, providing short-term solutions that only partially prevent future incidents [45]. When medical errors occur or patients are harmed, the first reaction of many healthcare organizations is, at best, to call for additional training for doctors or, at worst, to blame them. This is despite the fact that we know from human factors that calling out and blaming are weak and ineffective measures for achieving lasting improvements in a challenging work environment. Strong approaches such as systems redesign have been promoted in healthcare through strategic documents for at least a quarter of a century. Incident reporting is fairly well established in healthcare worldwide, but such information could be used more effectively to identify error-prone aspects of operating systems on which redesign efforts should be focused [42, 44].

Various strategies to reduce medication errors during anesthesia have been proposed since 1849, when J. Snow first advocated the use of a special chloroform mask to reduce concentration errors during inhalation anesthesia [46]. However, some problems have remained resistant to change. Among them, prescribing medications and checking equipment, which should be carried out by staff, are often ignored. Therefore, the new patient safety paradigm includes: standardizing the definition of serious critical events in medicine through increased reporting and the development of clinical evidence-based management protocols [37, 47]. Until recently, there were no nationwide mechanisms for detecting MEs and adverse events in anesthesia practice in Ukraine. Currently, three independent anesthesia groups have developed and successfully tested the «Patient Safety Supplement to the Anesthesia Card», which became the first step towards creating a future perfect system in this specialty. The technological protocol contains forms for registering general and directly related to anesthesia and surgery information about critical incident, incidents with drugs, blood products and medical devices. Root cause analysis is one of the main approaches to patient safety in medicine and serves as a mechanism for providing feedback in a closed loop «problem-analysis-solution» [36, 48]. In the global context of medical errors, it is appropriate to invest in robust audit, detection and reporting systems. The growing recognition that medication errors are usually the result of system failure rather than individual error should be promoted to allow for greater learning, an approach that has been successful in other safety-critical industries [29]. Timely monitoring and documentation of MEs significantly reduce negative outcomes [49].

It would be advisable to introduce a new structural special unit with vertical and horizontal integration in medical institutions of Ukraine, create and modernize inter-hospital simulation centers for practicing everyday to exclusive clinical skills and situations with a multidisciplinary team. To solve the problem under consideration, efforts are needed from both medical professionals and lawyers, as well as from the state. Thanks to transparency and the publication of such information, doctors will be able to identify medical errors and correct them in the shortest possible time with minimal physical, material and moral losses for the patient [50].

Healthcare professionals are generally conscientious professionals who do their best [42]. But in today's world, where people are informed and medical claims are increasing, addressing this problem is of utmost priority. Individual efforts to reduce medication errors alone may be unsuccessful until appropriate changes are made to existing protocols and systems. To prevent medical errors, it is necessary to adapt and implement basic international patient safety programs to the conditions of Ukraine, stop the blame game, accept mistakes, and develop a safe and fair non-punitive culture of attitude towards medical errors and incidents [48, 51]. This is a question of priorities in the face of resource constraints, a call that must be taken up by department and hospital managers, leading specialists and individual practitioners [52]. Today, it is necessary to create conditions where the state adopts laws that protect the rights and support the status of a doctor, oblige the state not to treat a medical worker as the lowest-paid representative of the budget sector, improve the working conditions of medical workers, as well as their professional training, and increase financing of the healthcare system, in particular, significantly increase the remuneration of doctors, first of all, and encourage them to improve their qualifications (category). Similarly, issues of protecting the rights of medical professionals should be resolved at the state level [50].

New technologies have much to offer and investment in new fail-safe drug delivery systems is warranted, but the importance of simple sensible changes and better education should be remembered [29]. A human factors education and training pathway using classroom instruction or an electronic educational package that can be used to support staff training and achieve the necessary «depth and richness» of workforce knowledge [53]. At the stages of medical education, the development of methodological materials taking into account the peculiarities of the logic of medical thinking can improve the quality of professional conclusions and reduce the number of medical errors. There is a belief that error-free clinical practice is the result of quality education. Attending advanced training courses for older anesthesiologists and younger colleagues is one of the main ways to prevent and correct cognitive age-related changes. The frequency of advanced training courses for specialists of older age groups should be increased in direct proportion to the increase in work experience. Educational simulation potentially plays a large role in medical education, but, unfortunately, has not yet become a mandatory part of training.

Human factors play a key role in all major critical incidents, and anaesthesiology training in the UK now includes human factors analysis as part of the core curriculum and continuing professional development for anaesthesiologists [47].

Simple vigilance, standardized protocol, and «think before you act» are key factors in avoiding treatment errors. There is always something to learn from ME. To properly manage errors and prevent future accidents, we must have a specific system for detecting these events, analyzing the causes, and developing protocols for appropriate changes [32, 34]. By failing to proactively acknowledge and address the growing health costs and economics of diagnostic errors, we are missing an important opportunity to provide optimal patient care and achieve better financial performance for health systems [54].

Conclusions

1. Currently, anesthesia error remains an urgent problem in modern medicine.

2. Anesthesiological error can be directly related to the human factor, but it can also depend on objective reasons.

3. Most anesthesia errors are preventable.

Conflict of interest

The authors declare no conflicts of interest and no personal financial involvement in the preparation of this article.

Authors contributions

Kravets O.V., Ploshchenko Yu.O. — conceptualization, editing.

Yekhalov V.V., Sedinkin V.A., Stanin D.M. — literature search, original manuscript writing.

Lavrova H.I. — translation.

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Анестезіологічна помилка. Частина 3 (огляд)

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Анотація. Причинними факторами медичних помилок визначені невиконання перевірки, неуважність, відсутність пильності та необережність. В епоху, коли знання та обізнаність пацієнтів про хвороби та їх лікування розширюються, клініцистам потрібно бути більш пильними, щоб уникнути сумних результатів і судових позовів. ***Докази отримання інформації***. Виконано інформаційний ретроспективний пошук літературних джерел за просторово-векторною моделлю дескрипторної системи, що базується на класифікаторах, який доповнений шляхом ручного пошуку наукових публікацій. ***Матеріали та методи.*** Отримання наукової літературної інформації виконано з використанням інформаційних пошукових систем Scopus, CrossRef, Google Scholar та PubMed та доповнене ручним пошуком використаних статей. ***Синтез доказів.*** Всесвітня організація охорони здоров'я вважає діагностичні помилки однією з п'яти провідних причин порушення безпеки пацієнтів. З багатьох причин діагностика в первинній медичній допомозі (тобто при першому контакті, доступній, безперервній, комплексній та скоординованій медичній допомозі) являє собою сферу високого ризику для помилок. Діагностичні помилки включають запізнілу, неправильну та пропущену діагностику. Це може призвести до шкоди через упущення (наприклад затримку або відсутність лікування недіагностованого стану) та/або вчинення дій (наприклад лікування помилково діагностованого стану). Епідеміологічні дані вказують на те, що «класичні» ускладнення (невдача або помилка в проходженні дихальних шляхів) стали більш рідкісними. Невикористання альтернативних методів проходження дихальних шляхів визнано неправильною практикою, що є нагадуванням про важливість навчання, щоб стати експертом у складних рекомендаціях щодо управління дихальними шляхами. Моделювання дихальних шляхів у процесі оволодіння технікою інтубації трахеї залучає персонал усіх класів, покращує збереження навичок, а також здатне висвітлювати приховані помилки та неякісні процеси. Наслідки помилки обладнання при анестезії можуть бути тяжкими. Анестезіологічні апарати еволюціонували до такого рівня, що потрібно кілька одночасних помилок, щоб спровокувати спричинення шкоди пацієнту. Проста пильність, стандартизований протокол і «подумай, перш ніж діяти» є ключовими факторами, щоб уникнути помилок при лікуванні. ***Висновок.*** Наразі анестезіологічна помилка залишається нагальною проблемою сучасної медицини. Анестезіологічна помилка може бути прямо пов'язана з людським фактором, проте може залежати від об'єктивних причин. Більшості анестезіологічних помилок можливо запобігти.

Ключові слова: анестезіологічна помилка, діагностична помилка, технічна анестезіологічна помилка, помилка обладнання.

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Надійшла до редакції/Received: 30.01.2026

Прийнято до друку/Accepted: 04.02.2026