SAFETY TRAINING – CRUCIAL IN ANAESTHESIOLOGY EDUCATION

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Abstract
Anaesthesiologists are responsible for procedures performed in a multidisciplinary team. The complexity of procedures, the burden of responsibility, time pressure, efficiency demands, psychological and physiological limitations, the necessity for quick and accurate decision-making, and many other challenges pose a risk of error. The purpose of this paper is to highlight the role of human factors in the occurrence of errors during anaesthesia procedures, as well as to identify strategies, which implementation into the training process and clinical practice of anaesthesia could support the safety of the therapeutic process. This paper discusses selected issues that, in our opinion, should be a permanent element of training and periodic qualification improvement among anesthesia team members.

Introduction

Dangerous practices and errors during the therapeutic process are among the most significant challenges in modern medicine. According to WHO data, the costs associated with medical errors reach 42 billion dollars annually (*Global Burden of Preventable Medication-Related Harm in Health Care: A Systematic Review. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO.*, n.d.). The incidence of

preventable patient harm is 6%, of which one-tenth is serious or potentially life-threatening (Panagioti et al., 2019). Human factors, which cannot be fully eliminated (Reason, 1995), account for part of the errors. Making mistakes is a natural part of the learning process and performing mastered activities. The complexity of procedures, collaboration in a multidisciplinary team, the burden of responsibility, time pressure, efficiency demands, psychological and physiological limitations, the necessity for quick and accurate decision-making, and many other challenges in the work of anaesthesiologists increase that risk.

Analogous challenges are a daily reality for aircraft crews. Noting the similarities in the functioning of crews and anaesthesiological teams, the training system used in aviation has been analyzed, which, adapted to clinical practice, could positively influence the safety of the treatment process. The area of training discussed in this paper is soft skills focused on effective "Crew Resource Management" (CRM). Analysis of aviation accidents has shown that technical skills and equipment reliability alone are not sufficient to ensure safety (Maurino & Salas, 2010). The goal of the training is to develop skills that allow anticipating threats, detecting errors, and responding to them, minimizing their adverse effects, thereby improving the safety of conducted procedures. Below we will discuss selected issues that, in our opinion, should be a permanent element of training and periodic qualification improvement among anesthesiologists.

Discussion

Managing threats and errors

It should be assumed that threats will arise, and errors will be made. The results of a survey conducted among anaesthesiologists in New Zealand indicate that the problem is widespread. Among the respondents, 89% admitted having made a medication error in their career (Merry & Peck, 1995). Errors happen among everyone, including experienced professionals (Gaba, 1989). It is important to emphasize that errors, unlike violations, are not intentional. Single errors usually do not have negative consequences. Adverse events are the result of many factors that act simultaneously ('The Contribution of Latent Human Failures to the Breakdown of Complex Systems', 1990). The model illustrating this theory is James Reason's Swiss cheese model, in which each slice represents safety measures, while the holes depict the imperfections of each element in the system. The alignment of the "holes" results in a cascade of events and, consequently incident and potential harm to the patient. Members of the medical team must be aware that they are part of a complex safety system contributing to the cumulative end point.
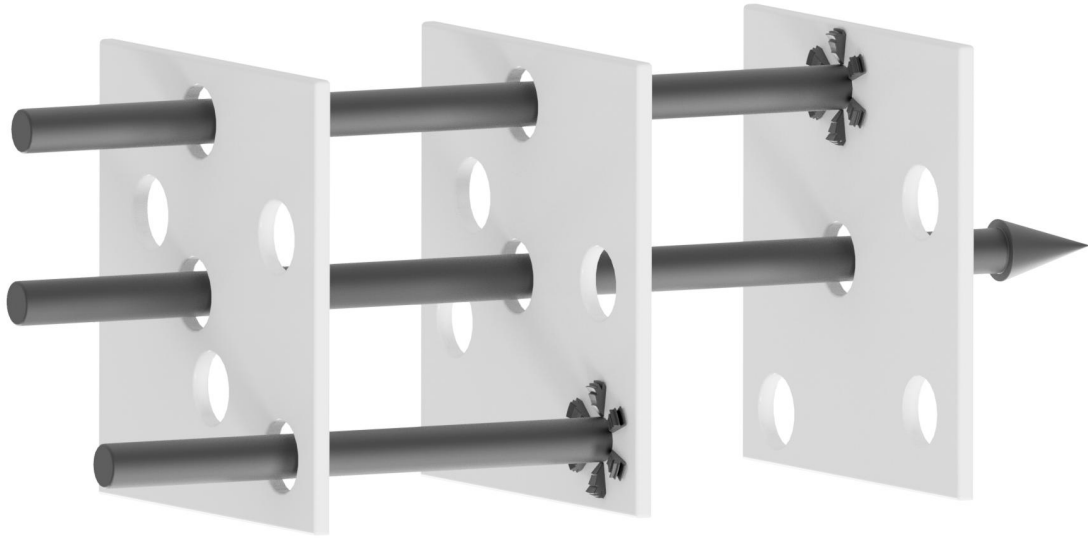
Figure 1. Schematic representation of James Reason's Swiss cheese model

Counteracting harm involves three Levels:

1. Avoiding errors by anticipating and minimizing threats
2. Identifying and eliminating errors
3. Mitigating the effects of adverse events

For obvious reasons, maximizing the effectiveness of the first level is the most desirable; however, absolute perfection in this area is not possible. Teams must actively search for and eliminate errors. Incidents that do occur should be analyzed in terms of their causes and ways to prevent them in the future.

Figure 2. Cascade of factors contributing to incident

Organization

Given the significant complexity of medical procedures, tools that organize activities and standardize approaches are helpful. Their use reduces the impact of human factors such as fatigue, stress, perception and information processing disorders, memory limitations, and also facilitates decision-making and improves situational awareness.

Standard Operating Procedures

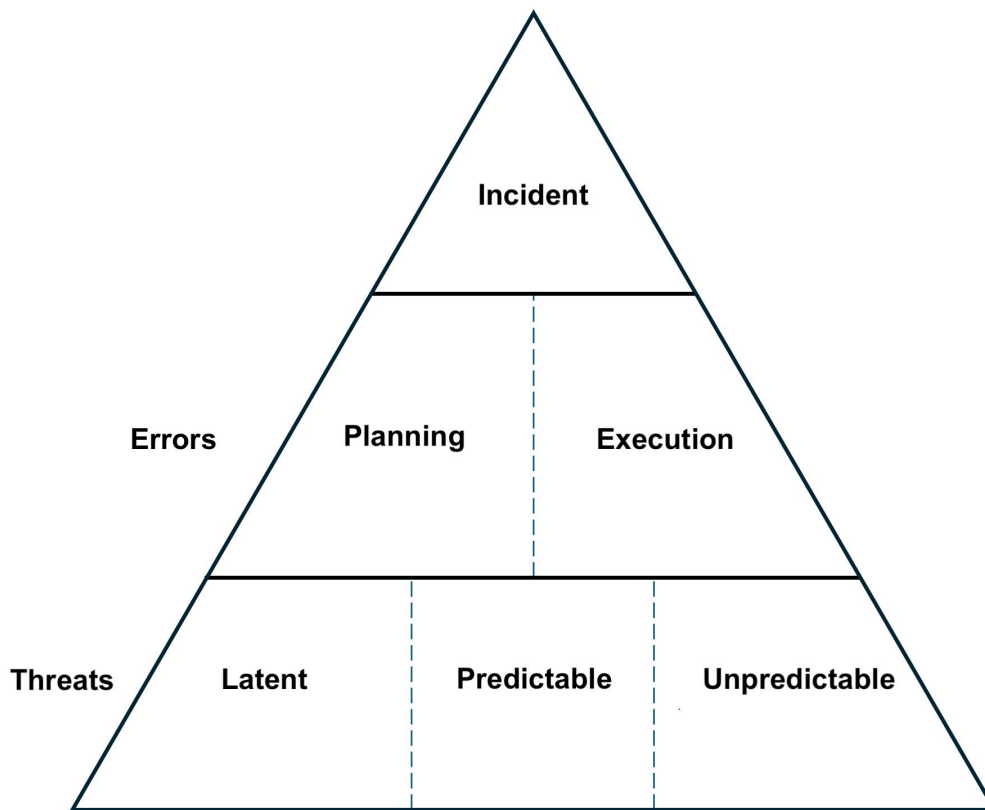The Helsinki Declaration on Patient Safety in Anaesthesiology identified 10 key areas that should be covered by procedures in facilities providing anaesthesiology services (Mellin-Olsen et al., 2010). Anaesthesiology teams should be familiar with the protocols, trained in their application and actively participate in their periodic evaluation. It should also be acknowledged that standard procedures may be insufficient for addressing unusual problems, and teams must remain flexible in their application.

Management bodies are responsible for providing adequate tools and ensuring an environment that promotes adherence to established rules. Given the need for continuous quality assessment, employers should encourage reporting of potential problems, errors, or violations that occurred during protocol application.

Examples of standard operating procedures include documents regulating patient care, equipment handling, and also team functioning. The latter are particularly important but often undervalued in the medical environment. A

survey conducted among doctors revealed that 83.1% of respondents, despite experiencing severe symptoms of illness, came to work at least once, citing organizational reasons and fear of ostracism (Szymczak et al., 2015). Anaesthesiologists seem to particularly underestimate the impact of stress and fatigue, overestimating their resilience to these factors (Flin et al., 2003). Implementing procedures for the deterioration of the psychophysical condition of staff could reduce the scale of this phenomenon.

Checklists

Checklists organize step-by-step actions, reducing the risk of omitting important steps. It has been proven that checklists improve patient safety by reducing the impact of human factors on the final outcome and decrease mortality (Thomassen et al., 2014).

Among the most commonly used is the perioperative "Surgical Safety Checklist" proposed by WHO (WHO Patient Safety & World Health Organization, 2009). A good checklist is one that is used. Checklists not accepted by the team, considered unnecessary or too time-consuming, are not utilized (Thomassen et al., 2011). Teams must be aware of the benefits and trained in use.

Increasingly popular are expert initiatives developing publicly available, free checklists modeled after aviation checklists for crisis situations. They facilitate actions in rare clinical situations requiring immediate intervention. Among them, the following can be mentioned:

- **Stanford Anesthesia Cognitive Aid Program – Emergency Manual** (*Stanford Anesthesia Cognitive Aid Program,* Emergency Manual: Cognitive Aids for Perioperative Crises, Version 4, 2021. See Http://Emergencymanual.Stanford.Edu for Latest Version. Creative Commons BY-NC-ND (Https://Creativecommons.Org/Licenses/by-Nc-Nd/4.0/Legalcode). *Goldhaber-Fiebert SN, Austin N, Sultan E, Burian BK, Burden A, Howard SK, Gaba DM, Harrison TK.*, n.d.).
- **Obstetric Anaesthesia Emergency Manual** (*ABIR G, SELIGMAN KM, and CHU LF. Obstetric Anesthesia Emergency Manual, Stanford Anesthesia Informatics and Media (AIM) Lab, 2019. See Http://Http://Cogaids.Stanford. Edu/ for Latest Version. Creative Commons BY-NC-ND. 2019 (Creative Commons.Org/Licenses/by-Nc-Nd/3.0/Legalcode).*, n.d.).
- **Pedi Crisis Critical Events Checklists** (*Pedi Crisis Critical Events Checklists*, n.d.).

Algorithms and Cognitive Tools

Algorithms and cognitive tools support memory processes and decision-making (Greig et al., 2023). Complex problems must be broken down into simpler elements according to priority hierarchy to be effectively managed. The use of algorithms and cognitive tools is particularly important in life-threatening emergencies (S. Marshall, 2013). Learning from these tools and applying them in clinical practice helps the team maintain situational awareness (S. D. Marshall et al., 2016). Examples of cognitive tools useful in anesthesiology practice are presented below:

- ALS Algorithm (Soar et al., 2021) – management of cardiac arrest.
- ABCDE Approach (Peran et al., 2020) – Airway, Breathing, Circulation, Disability, Examination – initial patient assessment.
- SAMPLE Mnemonic – Symptoms, Allergies, Medications, Past history, Last meal, Events – quick subjective examination.

- VORTEX Model (Chrimes, 2016) – decision-making process in difficult airway situations.

Communication

Effective communication is an undeniable element of the safety system. Disruptions in the flow of information contribute to many preventable incidents. The European Board of Anaesthesiology recommends that every team member should express their opinion if they feel that patient safety is at risk (*Speaking up for Safety - Recommendations from the EBA*, n.d.). Staff should be aware of the barriers (Table 1) that disrupt the proper flow of information among team members and use techniques that improve communication.

Table 1. Barriers and beliefs disrupting communication (Preckel et al., 2020), (Voogt et al., 2020)

Barriers	Beliefs
Hierarchy	My comment will be seen as disrespectful
Differences in seniority	I'm still learning, I won't question the expert's opinion
Fear of punishment	If I object, they will stop liking me
Uncertainty	I might be wrong
Lack of time	There's no time for discussions
Fear of being misunderstood	I don't know how to say it properly
Discouragement	I've mentioned it before, and nothing changed
Conformity	No one else is saying anything, so I won't either
Fear of being seen as incompetent	Better not to ask, I should already know this

Tools to overcome these barriers

Tools to overcome the above barriers have been gathered by the Agency for Healthcare Research and Quality in the TeamSTEPPS (King et al., 2008) program, and the positive impact of these techniques on clinical practice has been confirmed (Shi et al., 2024). Familiarizing aneasthesiology teams with the proposed communication techniques would help reduce misunderstandings and support conflict resolution. Mutual verification of performed tasks is desirable, and expressing doubts aloud should not be seen as questioning competence but rather as caring for patient safety. Useful techniques include:

- **Two-Challenge Rule** – a technique for articulating safety concerns to higher-status team members.
- **DESC Script** – a tool for assertively expressing opinions using non-aggressive language.
- **Closed-Loop Communication** – a technique that reduces misunderstandings.

Team collaboration

A good team is characterized by trust, mutual respect, and a cooperative attitude. Effective task execution is possible due to a focus on a common goal. Applying techniques that facilitate collaboration not only improves safety but also enhances job satisfaction and reduces the risk of burnout. Team members should know their roles and responsibilities in task execution.

Leaders play a role in supporting positive attitudes and appreciating team members' engagement. Techniques that improve team performance include constructive feedback and debriefing.

Constructive feedback

Constructive feedback is given shortly after an event that needs discussion. The message is delivered with respect to the recipient and acknowledges their strengths. It focuses on areas needing improvement and highlights the impact of improper practices on patient well-being.

Debriefing

It is crucial to discuss incidents that could have led to harm or resulted in harm. The aim is to develop strategies to prevent similar situations in the future and provide support to team members who made a mistake. Incident analysis should focus on system causes and deficiencies rather than on the individuals involved.

Conclusions

- Human errors in anaesthesiology practice cannot be completely eliminated
- System solutions that reduce the risk of errors should be implemented
- There are numerous tools with proven effectiveness that develop soft skills and improve safety in clinical situations
- Training in error prevention, communication, and teamwork should be a permanent part of anesthesiology team training

Informed Consent Statement
Not applicable

Data Availability Statement
Not applicable

Conflict of interest
The authors deny any conflict of interest

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