



Safe but complex?

Prevent and manage critical incidents

in anaesthesia

While anaesthesia associated mortality has declined remarkably over the last decades, the number of critical incidents is still significant. But why is it so difficult to control the occurrence of perioperative critical events? Anaesthesia is not just complicated, but highly complex and tightly coupled. Read on to learn why working in anaesthesia can be considered as far more complex than working in the cockpit of an airplane.

SAFE SPECIALTY WITH DEMANDING CHALLENGES?

In anaesthesia, perioperative mortality has declined remarkably over the last decades ². Factors like availability of sophisticated technology, improved anaesthetic drugs as well as training concepts, guidelines and standardisation have decreased mortality attributable to anaesthesia close to standards of high reliability organisations like air traffic control ³.

Anesthesia-related mortality incidence per 10,000 anesthetics*

Only a small number of patients still dies due to anesthesia-related causes.



But how high is anesthesia-related morbidity?

*according to studies performed in different countries between 1997 and 2006

While 50 years ago, deaths in healthy patients directly caused by anaesthesia were in the range of 1-2 per 10,000 anaesthetic cases, numbers are now closer to 1 per 100,000⁴. Nevertheless, there are large worldwide differences in these numbers. For

example, in a study including surveys from 1995 – 2008, the rate of anaesthesia-related mortality in Taiwan was still about 1 per 10,000 and therefore was about 10-fold higher than e.g. in the United States, Japan and the United Kingdom⁵.

“Mortality due to critical incidents has decreased – so, everything is fine...?”

Even though fatal incidents have markedly decreased in western countries, the number of critical incidents leading to (peri) anaesthetic morbidity are still significant. In the NAP4-report (4th National Audit Project in the UK), the authors calculate the incidence of serious airway complications during general anaesthesia

to be (at least) 1 per 22,000 general anaesthetics with aspiration as the major contributor to airway-related morbidity and mortality in anaesthetic practice⁶. In most cases, human factors are claimed as the underlying cause of the event, but often these factors are just the endpoint of a multi-layered process⁷.



In his TED Talk “Doctors make mistakes. Can we talk about that?”, Brian Goldman passionately talks about medicine’s culture of denial and shame that keeps doctors from talking about mistakes. He stresses the urgency to create an atmosphere to voluntarily report mistakes without fear so as to give room for learning and improvement. Although Brian Goldman held his talk ten years ago, this problem is still an issue today.

“What we do though is we send each one of them, including myself, out into the world with the admonition, be perfect. Never ever, ever make a mistake, but you worry about the details, about how that’s going to happen.” (Brian Goldman, TED Talk 2010)



Do you want to learn more about “human error in anaesthesia”? In our White Paper, we describe this topic in detail:



Human error
Part I



Human error
Part II

CONSEQUENCES ARE CONSIDERABLE – IN MANY RESPECTS

The consequences of complications may involve patients, families, caregivers, clinical staff as well as organisations with considerable impact on physical and emotional health, finances and reputation. Of course, the outcome of the patients is in the focus of attention,

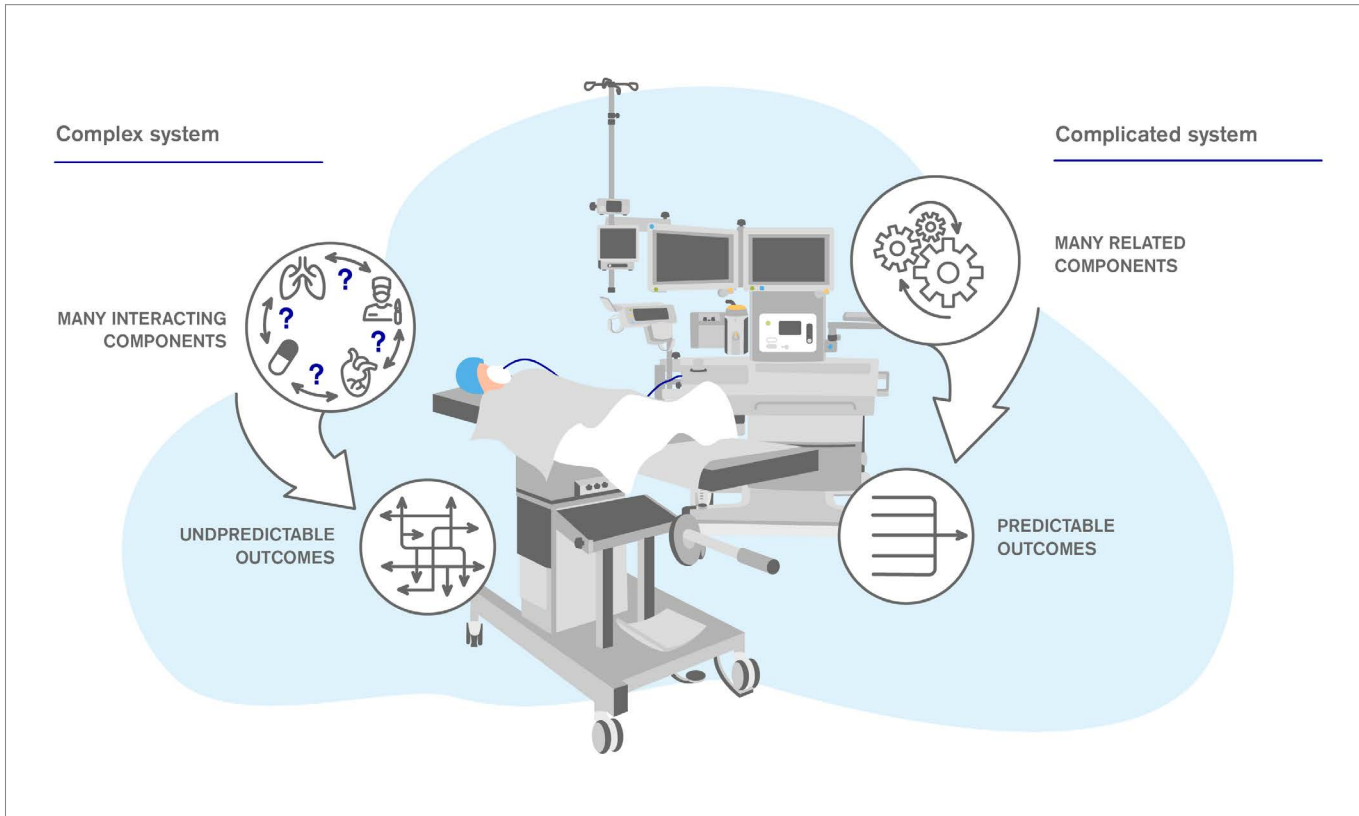
but the impact on the healthcare providers themselves should not be overlooked with resulting feelings like guilt, anxiety or depression (“second victim”⁸). Besides, the financial implications are also of considerable relevance: for example, the costs of medical liability in the U.S. are estimated to be about \$60 billion a year⁹. But why is it so difficult to control the occurrence of critical incidents?

COMPLEX OR COMPLICATED?

In comparison to some industrial branches, healthcare is a complex system with a large number of components that interact, change (even during interaction), and often cannot be predicted. While

“complicated” systems are linear and deterministic, “complex” systems are not: you don’t get the same output, even if you come from the same starting point.

Complex vs. Complicated Systems



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Example: An anaesthesiologist takes care of patient A and patient B. Both patients (of the same age and gender) suffer from the same disease without any known comorbidities. On the day of the surgery, the same anaesthetic drugs are administered, and the same ventilation settings are made. While patient A recovers swiftly from a “normal” anaesthesia, the anaesthesia of patient B runs completely different:

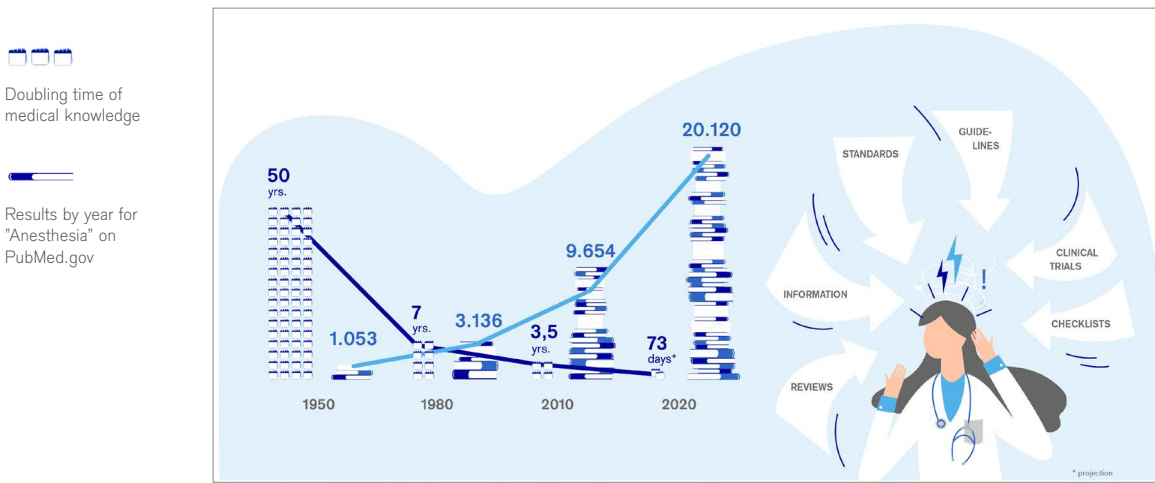
Patient B reacts to the given drugs with unusual pharmacodynamics that require permanent readjustment; surgical complications occur and suddenly the oxygen saturation decreases; accompanied by a colourful and loud concert of various alarms, the anaesthetist tries to find the problem; it is a new anaesthetic device and you struggle to find technical help; finally, he finds a leak and is then able to stabilise the patient.

This hypothetical example demonstrates the unpredictability in everyday anaesthesiology. Task complexity is very demanding and even rising. Knowledge is growing exponentially, and various guidelines are published for every clinical scenario. Patients get older and accompanying comorbidities may interact with the usual treatment. Besides, the anaesthesiology staff is confronted with a high workload and a challenging work environment. Cost pressure - communicated by the operating theatre management – in

combination with the implication to work as effective as possible to increase revenue and profit also act as a stressor. In a survey of European leaders in anaesthesia about patient safety, there were three commonly cited areas of change in the last years: an intensifying workload, more challenging patients and suboptimal pre-operative preparation. Respondents also reported the temptation to 'cut corners' to get the work done ¹.

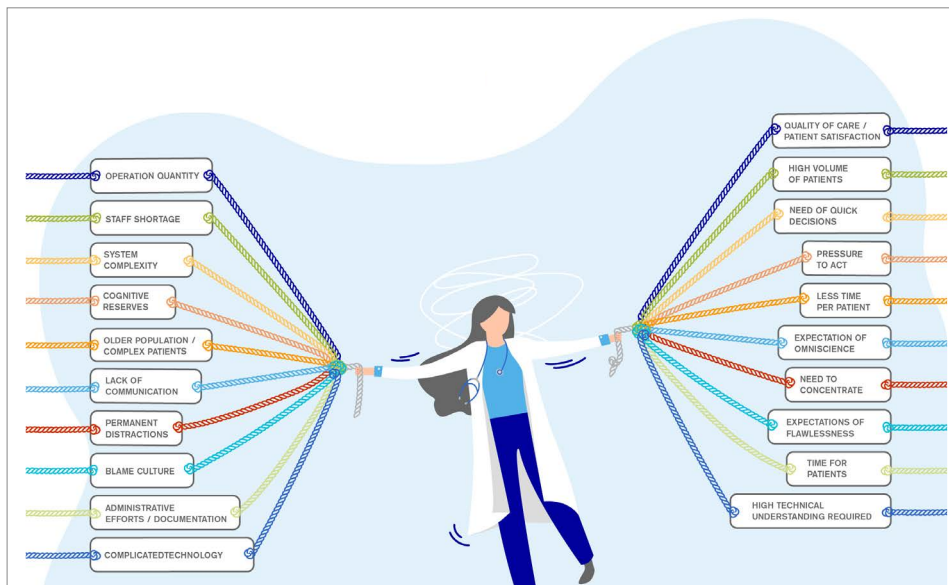
Medial knowledge is growing exponentially

If you started studying medicine in 2010, the amount of facts tripled by the time you passed your state examination.



The anaesthesia care team is often confronted with a high workload in a challenging work environment – quite often with the feeling of having to tear themselves apart struggling with the various demands.

Tug of war in anaesthesia



COMPLEXITY AND THE NEED OF SYSTEMATIC CHANGES

Anaesthesia can be considered as even more complex than working in an airplane cockpit: different specialties working together in an environment with various individual and in some cases unpredict-

table factors. These complex and tightly-coupled systems bear the risk of incidents – but in the often practiced “blame culture”, these incidents are not “allowed”. Read on to learn why a re-thinking of safety is necessary.

“Aircraft tend to be more predictable than patients.”¹⁰

Anaesthesia is often compared to aviation. Both workplaces are complex, highly dynamic and the outcome is mainly influenced by human performance. But working in an operating room can be considered as even far more complex than working in a cockpit, because different specialties are interacting to treat a patient whose state and responses can be unpredictable¹¹ and the degree of coverage with standards is low, simply due to uncountable combinations of various individual factors (patients, tasks, working conditions, etc.). Highly specialised equipment and technology might help to handle the complex situation, but technology itself could also contribute to the complexity with an overload of displayed information or non-intuitive operability. Human machine

interfaces and therefore the usability of anaesthesia devices differ considerably between different ventilators and have the potential to facilitate but also to impair the operator's performance¹². An exponential growth of knowledge, a high cognitive workload, permanent distractions and the demand to be highly concentrated and work as fast and effective as possible even under stressful situations do not help in always keeping track of the situation.

In addition to the complexity of the environment, processes in the operating theatres are also “tightly coupled”, i.e. it has time-dependent processes that cannot wait: The actions of the anaesthesiologist will impact the patient in an immediate, time dependent way¹¹.

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“For example, an intravenous drug is given and there is a quick physiological response by the patient. Similarly, failure to secure an airway in a paralysed patient leads to prompt, adverse physiological consequences.”¹¹

By their nature, these complex and tightly coupled systems bear the risk of incidents.

NAMING, BLAMING, SHAMING – STILL A PROBLEM?

In traditional medical culture, the individual is seen responsible for incidents and has to deal with the consequences on career and mental health. But acting in such a complex system, this approach is short-sighted. The individual performance of the anaesthesiologist (e.g. due to cognitive overload, distraction, fatigue or poor

interpersonal communication) is often just the endpoint of several factors of the complex system that have interacted and finally converged in the critical incident. Even if a technical error is the root of an incident, in the end humans are the ones who suffer from the consequences.

“... medicine is often driven by the idea that perfection is possible and that mistakes are a personal and professional failure. This perfection mind-set ... is laudable, admirable, and unworkable.”¹¹

In other words, to improve patients' safety, the blame culture will never succeed as humans are not able to work completely free of mistakes. There is the need for a system that enables individuals to admit what has happened to them and their patients so that they and others can learn from them. Besides, creating a work environment with less cost and work pressure and a re-thinking of

safety, like the concept of safety-II are more promising approaches (see our separate whitepaper). It should be stressed that a systematic approach to safety does not mean that staff can blame the system and deny any responsibility, but that individuals are aware of their contributions to safety ¹¹.

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“Accepting the inevitability of error and the importance of reliable data on error and its management will allow systematic efforts to reduce the frequency and severity of adverse events.” ¹⁰

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In our article on critical incidents in anaesthesia, we reviewed relevant literature and discussed with renowned experts to provide an overview. For references and details, please visit our website: www.draeger.com/patient-safety



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 Moislinger Allee 53–55
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