EMPIRICAL STUDIES

Beyond the monitors: Anaesthesiologists’ experiences of the process of extubation

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Abstract
Background: Although extubation is a high-risk phase associated with risk of severe complications for patients undergoing general anaesthesia, there is a lack of research about this phenomenon from the perspective of anaesthesiologists’ experiences of the process of extubation in the anaesthesia setting.

Aim: To describe Swedish anaesthesiologists’ experiences of the extubation process in the anaesthesia setting.

Methods: A qualitative descriptive design study with individual semi-structured interviews was conducted in three hospitals in Sweden with a total of 17 anaesthesiologists. A qualitative manifest content analysis method was used to analyse the data.

Results: The anaesthesiologists’ experiences were described in two categories: To assemble sensibilities, where the anaesthesiologists are receptive to inputs, create tailored plans, are guided by emotions and experiences, and sense the atmosphere in the process of extubation; and To stay focused, where they understand the importance of preparation and being prepared, and of being calm and strategic, and of needing to trust the registered nurse anaesthetist in the process of extubation.

Conclusions: Decision-making regarding the process of extubation does not rely solely on monitoring signs; rather, the anaesthesiologists described how, by looking beyond the monitors and by being receptive to inputs from the patient and other professionals, their experience and intuition guides them through the process of extubation.

KEYWORDS
anaesthesia setting, anaesthesiologist, content analysis, decision making, extubation process, operating room, qualitative, teamwork

BACKGROUND
Caring for a patient during a surgical operation demands an interdisciplinary team approach, and the role of the anaesthesiologist is integral to providing safe and efficient care [1]. Establishing a secure airway and keeping it safe are essential elements of anaesthesia practice. The removal of the endotracheal tube (ET), the process of extubation, is a high-risk phase [2], related to severe respiratory or circulatory complications, such as laryngospasm, bronchospasm, aspiration, hypertension or tachycardia, leading to increased morbidity and mortality.
[3,4]. Complications related to the extubation process are also almost three times more likely to occur than those related to intubation [5]. Twenty-three percent of the severe anaesthesia airway-related complications occur at the extubation [6]. In addition, the number of respiratory complications associated with extubation have not decreased over the past two decades, while those related to intubation have [5]. Therefore, it is important to evaluate risk factors related to anaesthesia during a surgical procedure and the patient’s condition when deciding when to extubate [7].

Anaesthesiologists in Sweden work in various different medical settings [8], and perform extubations in some of these settings. Depending on the country of residence and physical condition of the patient, practice differs regarding whether a registered nurse anaesthetist (RNA) or an anaesthesiologist is responsible for the extubation. Generally, two European models can be identified: I) RNAs are allowed to intubate, extubate and maintain anaesthesia with the direct or indirect supervision of the anaesthesiologist and II) anaesthetics nurses/circulation nurses assist anaesthesiologists and cannot monitor patients and maintain anaesthesia alone. Countries such as Bulgaria, the Czech Republic, Denmark, Estonia, France, Hungary, Iceland, Lithuania, Luxembourg, the Netherlands, Norway, Poland, the Slovak Republic, Switzerland and Sweden adhere to model I [9,10]. Although anaesthesiologists in Sweden are often responsible for several patients who are under anaesthesia at the same time, and because the extubation itself is a duty shared between the anaesthesiologists and RNAs, the anaesthesiologists are often present in the OR only at the induction and ending of anaesthesia or if there have been any complications [11]. The anaesthesiologists keep themselves informed when they are not present in the OR, and thereby maintain control over the situation [12]. Swedish RNAs experience extubation as being more complex than the intubation, due to the patient’s vulnerable state and the potential disturbances that might occur at the time of the extubation [13]. Further, they report the importance of a having a pre-established plan and of preparing the patient. In addition, by combining earlier experiences with intuitive feelings, the patient’s condition, and situation awareness, the RNAs decide when to extubate. However, few studies describe how anaesthesiologists experience the extubation process, although they have ultimate responsibility for resolving airway problems [14] and they facilitate the work of RNAs [15].

**AIM**

To describe Swedish anaesthesiologists’ experiences of the extubation process in the anaesthesia setting.

**METHOD**

**Design**

A qualitative descriptive design with an inductive approach was used, searching for in-depth knowledge and emergence of patterns found within data about the phenomena in focus [16]. The level of abstraction and degree of interpretation was considered low in this study [17].

**Participants and setting**

In this study, the term *anaesthesiologist* includes both anaesthesiologists and physicians training to become anaesthesiologists, as the focus of the research was the experiences of those who perform extubations. All employed anaesthesiologists in three hospitals in Sweden, a total of twenty-eight, received information about the study, both verbally and by e-mail, from the first author. The information also included a note to the anaesthesiologists to start to reflect upon a normal, a difficult and a well-managed extubation that they had handled. Seventeen anaesthesiologists showed interest in participating and were recruited via a consecutive selection process to participate in individual semi-structured interviews during working hours, after signing a written consent form. This selection strategy was chosen to promote the possibility of including the participants at a given period of time, that is those scheduled to work on the days on which the data collection took place. The included hospitals were geographically separated and consisted of one university hospital and two county hospitals. All three anaesthesia departments care for patients of all ages in different surgical specialties. Of the 17 included participants, twelve were men, mean age 45 (32-64), and five were women, mean age 48 (28-58). The participants had between one and 40 years’ experience working as an anaesthesiologist. Choosing participants with various experience increases the chance of including a broad variety of aspects regarding the research question [16]. The participants were recruited to this study between August and September 2017.

**Data collection**

We chose to use semi-structured interviews [18] to collect data, using an interview guide with open-ended questions to capture the anaesthesiologists’ experiences of the process of extubation. Semi-structured interviews seek to obtain descriptions of the participant’s experiences to aid interpretation of the meaning of the phenomenon. They allow the interview to progress as a conversation, while
focusing on the purpose of the research. The interviews focused on the situations they had been asked to reflect upon and started with the question: *Tell me about…*, encouraging them to share their experience of the situations that they had been asked to reflect upon. Depending on the answers provided by the anaesthesiologist, follow-up questions, such as *How did you feel?* and *What did you think at the time?* were asked to guide the interview further [18]. The interviews took place in a room separate from other staff members. A total of 17 interviews were performed in three county hospitals: four, eight and five interviews, respectively, in each hospital. All interviews were conducted by the first author between September and October 2017, were digitally recorded, and lasted between 28 and 52 minutes. A pilot interview was performed prior to the interviews to test the appropriateness of the questions but was not included in the analysis.

Data analysis

Data were analysed using qualitative content analysis, as described by Graneheim and Lundman, focusing on the manifest content of the text [19]. Manifest content analysis deals with what is visible in the text and what the text says to you [20]. Qualitative content analysis provides a systematic description of patterns and variations between the participants’ accounts [16]. The first author transcribed the interviews verbatim. To obtain a sense of the whole, the transcripts were then read and the interviews were listened to several times to gain an overview of the content, and an overall impression of the anaesthesiologists’ experiences of the process of extubation. Data were sorted and structured using QSR NVivo 10©. Keeping the aim and context in focus, the text was divided into meaning units, which consisted of excerpts from the text. These were condensed, describing the content of the text, and were abstracted and labelled with a code. The codes were compared and sorted by similarity into sub-categories and categories [19] (see Table 1). To achieve credibility, it is important to select the most suitable meaning unit and to not lose the meaning of the text during the condensation and abstraction process [19]. To facilitate this, all authors continuously discussed the analysis to ensure that the categories adequately describe the data, contributing to achieving the trustworthiness of the results.

| Meaning unit                          | Condensed meaning unit | Code  | Subcategory                  | Category                  |
|--------------------------------------|------------------------|-------|------------------------------|----------------------------|
| Think a step ahead, what do I do and do I have a plan | To be a step ahead by having a plan | Planning | Be prepared and prepare | To stay focused |

Ethics

This study was conducted in accordance with the Declaration of Helsinki [21] and was approved by the Regional Ethical Board in Umeå (Dnr: 2014-19-31 M). Information about the study aim and the participants’ role in the research process was provided beforehand, and a signed consent form was completed prior to the start of data collection. The anaesthesiologists were informed that their participation was voluntary and that they could withdraw at any time. They were also informed that data would be treated with confidentiality and presented so that they could not be identified.

RESULTS

The results describe the anaesthesiologists’ experiences, analysed with content analysis and sorted into a total of eight subcategories and two categories (Table 2).

To assemble sensibilities

Be receptive to inputs

In deciding when to extubate, the anaesthesiologists gathered the complex inputs they obtained before and during the surgery, appreciating and responding to these in being receptive to the information that each unique patient shared with them:

> By looking at and being touched by the patient I’m able to learn how he works, what’s best for him.

(P4)

They combined these inputs from the patient with being receptive to the relevant information that other professionals shared regarding the extubation via verbal and non-verbal communication. They also obtained inputs from the surrounding environment, including gathering data from the patients’ parameters from monitors, and by assessing blood and fluid infusion, and evaluating the effects of the anaesthetic drugs. These were all described as being important when deciding when to extubate.
They described how their own mental state affected them when it came to the extubation. If they were stressed, they perceived themselves as being unfocused, not receptive to the inputs of other professionals, and unable to take a step back and obtain an overview of the situation. In contrast, the earlier experience of being in similar situations guided them in how to cope with their emotions, listen to others, and trust their own feelings about when to extubate. They described the advantage of not only observing the monitors; they needed to take in the whole picture – see all aspects of the available inputs. This might mean allowing someone else to make the decision about when to extubate on their behalf.

Create tailored plans

When assembling these sensibilities, the anaesthesiologists created a mental plan, tailored for each patient, which was constantly revised in their being responsive to the patient's reactions to anaesthesia or surgery and their condition. Because of the complexity and unpredictability of the extubation, this plan worked to support them. To tailor the plans, they used information, such as skin colour and breathing pattern. Every action they took and every observation they made was brought together; the more focused they were, the easier it was to predict the outcome of the extubation, by building on their previous experience. They used their own involvement, by being present in the operating room (OR) or using the information they received from the RNA, to be prepared, which was perceived as taking precautions. They took in different aspects and the uniqueness of each patient in the plans they created.

When it is time for the extubation I use my mental template, which I can use to be focused when it comes to the extubation, the unpredictable and sometimes most difficult task during the entire anaesthesia.

(P5)

Being the one performing the intubation was perceived as being important for how they acted and determined when to extubate. If they had performed the intubation themselves and knew how it felt to ventilate that particular patient, it was easier for them to imagine the outcome of the extubation.

Guided by emotions and experiences

The anaesthesiologists described that they made a decision on when to extubate based on them being receptive to their own feelings as well as their observations of the patient. They acted on and gathered sensibilities from earlier experiences and their intuition guided them in their decision by leading their reactions to their emotions.

Anaesthesia is based on emotions, you are guided by the feeling you get, how you react and act depends on it.

(P16)

The anaesthesiologists described how, when they were inexperienced, it was frustrating to be told by others with more experience that they trusted their instincts or a gut feeling about when to extubate. Being inexperienced meant lacking the intuitive element, as well as lacking guidelines for performing the extubation. They also described how, with growing experience, they were guided by their emotions, trusting their feelings when something did not feel right, and by keeping calm.

The anaesthesiologists were aware of the importance of being attentive and at the same time being humble and not over-confident during the extubation. They described their knowledge and experience of how unpredictable and complex the extubation could be; sometimes they did not predict any trouble and yet the patient experienced complications. These unpredictable situations had taught them to stay focused and be humble in the process of extubation.

You can’t be too confident, you have to be humble with each extubation.

(P9)

Sense the atmosphere

The anaesthesiologists described how they, as the leader of the anaesthesia team, adhered to information of importance for the extubation by taking in the atmosphere in the OR:

When you open the door you feel it, you see if it looks peaceful and everyone seems to do what
they supposed to or if the surgeon is stressed and it looks messy in there. (P7)

They could detect trouble and identify stress by looking at the behaviours of others, or by listening to their voices. They created a picture of the mood of the OR, despite not having been there. When taking in the atmosphere and tuning in to being a part of the team of professionals surrounding the patient, they described the advantage of sometimes not being the one performing the extubation, instead, they had a view from the periphery, but were able to place the eventual problem in focus and thereby lead the anaesthesia team in a structured way in the process of extubation. They experienced the atmosphere in the OR by being the one leading the group in how to act. If they made small talk, the others also did, but if they set the tone in the OR to be quiet, it often was. They perceived this, the task of keeping the tone quiet and focused, as being easier for them than it was for the RNAs. The anaesthesiologists perceived it as mainly their responsibility to maintain quiet during the extubation, in the same way as for the intubation. They knew the importance of silence at the completion of anaesthesia for the patient.

To stay focused

Be prepared and prepare

Prior to the extubations, the anaesthesiologists prepared themselves by taking precautions and being attentive to avoid complications for the patient. If the patient was obese or affected by gastroesophageal reflux, they were prepared for any related complications that this may bring. If they expected complications, they wanted to be in the OR performing the extubation or assisting the RNA. To prepare the patient, a routine of establishing spontaneous breathing, normalisation of circulation, regained muscle strength and regaining consciousness was described. They also had to consider the patient’s preoperative condition, what anaesthetic drugs were used, and any previous skills and experience of handling complications that the RNA in charge of the patient had. To ensure safety during the process of extubation, the anaesthesiologists made sure that the anaesthetic drugs and the safety equipment were tested and ready to use, and placed near the patient.

I used to think that I want to have the same drugs and equipment that I had at the intubation, because of my knowledge that all extubation is potentially a reintubation. (P7)

By preparing themselves, they could focus on the extubation, and this also gave them the possibility to consider whether they believed they required assistance with the extubation.

Be calm and strategic

From previous experiences of extubations that did not end well, the participants knew they had to be ready for both expected as well as unexpected complications and that they needed knowledge of how to manage them. Despite the stress they felt in situations with airway trouble, they knew the importance of keeping calm and being strategic, in that they prioritised maintaining a free airway and adequate breathing. By staying calm, they influenced others to stay attentive, work together and stay focused to ensure patient safety. The participants described how they could feel stress in the situation of the extubation, but also that they felt safe if they had someone more experienced in the OR alongside them, helping them to work strategically:

It’s an incredibly stressful situation and at the same time I felt totally secure because I had someone else helping me to prioritize. (P12)

In situations when the tube was accidently removed, for example, when the patient’s position was changed without having the tube fixed to the patient, or when they extubated too early when the patient still was in the excitation phase, the anaesthesiologists took the role of leading the team. This they achieved by continuously communicating their plan and attempting to keep their voices at a normal level. They knew the importance of keeping the atmosphere quiet around the patient, especially when the patient was moving from being anaesthetised; keeping calm and staying focused is important for not worsening the situation and in prioritising tasks to ensure patient safety.

Trust the RNAs

To be in a team around the patient was described as being a part of something bigger, which had an effect on the decisions that they made. How familiar they were with the others in the anaesthesia team, and the level of competence that the RNAs had, influenced their decision on when to extubate. The anaesthesiologists described how, in the teamwork with the RNAs, they needed to trust that they could call on them if they expected trouble with the extubation or if an anaesthesiologist was urgently required to assist with the extubation. The anaesthesiologists described the loss of control they had
to deal with on a daily basis as the leader of the team as they were often responsible for several patients at the same time. Because of that, they were dependent on others to be able to focus, and, above all, they needed to trust the RNAs to care for the patient when they were not in the OR themselves.

As anaesthesiologists we rarely stand alone and extubate, we have the RNAs with us, it’s in collaboration with them we decide to remove the tube.

(P8)

They felt insecure if they worked with an RNA with whom they were not familiar, leading to a loss of focus in the process of extubation. In contrast, when working with RNAs they knew, they could tell whether help was needed and felt secure when leaving them with the patient, trusting the RNAs to call, for example, in an emergency situation where the patient experienced laryngospasm or hypoxia, or if the RNAs needed an extra pair of hands. The anaesthesiologists perceived this as something they had to deal with; they cannot be in all of the ORs at the same time. They spent a few minutes at a time with the patients, still in charge of patient safety, while depending on others to make relevant assessments to keep the patient safe. This was perceived as being difficult because they were in charge, even if they were not physically present in the OR.

**DISCUSSION**

Extubation, in this study, was described as a process during anaesthesia, including the anaesthesiologists’ ability to assemble sensibilities by looking beyond the monitors. By finding patterns they recognise, they gather information and create a picture of the extubation. This finding aligns with the Anaesthesiologist's Non-Technical Skills (ANTS) described by Flin and Patey [22] and is similar to how RNAs use situation awareness in the process of extubation [13]. Decision-making is a part of ANTS, including identifying and choosing between options, making risk-assessments and re-evaluating their decisions [22].

A relationship with the patient emerges beyond the monitors; the anaesthesiologists learn to know the patient by being receptive to inputs obtained from them, for example, how they react to surgery, anaesthetic drugs, or stimuli, and whether they breathe spontaneously or cough. This relationship can be interpreted as an I-Thou relation [23], characterised by subjectivity, recognition and acceptance of the unique other. Due to the anaesthesiologists’ ethical demand of keeping the patient safe in the complex environment of the OR, despite several disturbances [24], and being the one leading the anaesthesia team, they hold another person’s life in their hands [25,26]. The meeting of another person can been seen as an ethical obligation [25], and the anaesthesiologist who cares for the patient during the process of anaesthesia has an unspoken demand to take care of the person whose life is placed in their hands. When the patient shows trust by handing over the responsibility of themselves to another, it is a demand for the anaesthesiologists to receive and care for them. Because caring for another signifies meeting a demand that we cannot change, caring therefore commands a professional ethical sensibility [25]. In this, they consider their need to be humble in the extubation process with each patient because of their knowledge of the unpredictability of the extubation. They trust their feelings when something is not right, and act upon their intuition to prevent the patient from harm. Likewise, RNAs rely on their feelings and use their intuition and experience in the process of extubation [13]. Being the one who has the ultimate responsibility may produce feelings of inadequacy, as the anaesthesiologists described their vulnerability in the process of extubation. Being vulnerable is a presumption for being open to another’s vulnerability [25], which may indicate that they are open to what the patient tells them, in getting to know them before the anaesthesia. Wellar and Jowsey [27] describe a doctor-patient relationship characterised by compassion to provide high-quality care for the patients, which may be beneficial for both the doctor and the patient. The anaesthesiologists gather information about the patient’s condition by sensing the atmosphere in the OR, evaluating vital parameters, measuring neuromuscular function and degree of awareness, and looking beyond the monitors to perceive the whole patient. Similarly, RNAs, when building their experience, learn to observe the patient’s responsiveness during anaesthesia and integrate that with data from the monitors [28].

Anaesthesiologists combine intuition with other inputs in the process of extubation, similar to earlier findings [13], showing that RNAs confirm their gut feelings with their experience of similar situations and theoretical knowledge. Gut feelings or intuition is a knowledge- and experienced-based process that is relevant for clinical decision-making [29]. However, similar to the RNAs [13], the anaesthesiologists feel limited in trusting their intuition when they are inexperienced. The anaesthesiologists’ decision-making practices in this study are similar to the notion of clinical judgement, described by Tanner [30], as an ability to identify and wisely act upon changes in the patient’s condition in complex situations, followed by revised actions, depending on the patient’s response to earlier actions. As well as clinical judgement, intuition comes with experience [31]. These concepts also relate to phronesis, a mode of knowledge which is also learned from experience and has been described as other ways of knowing, and includes practices that are ethical and intuitive [32].
These results show how being strategic, calm and focused in safeguarding the patient in the process of extubation is an advantage for the anaesthesiologists. This is supported by the proposed strategy to start with supporting vital functions and to determine what is wrong when handling acute situations in critically ill patients [15]. While the anaesthesia team focuses on ensuring that the patient has a calm emergence from anaesthesia, there might be disturbances from the activities of other professionals in the OR, a practice that does not align with effective teamwork. Disturbances and interruptions in the OR may influence patient safety in a negative way [24]. A recent study [33] described that teamwork is not achieved simply by a group of people working together; they must also work towards a common goal. The anaesthesiologists must use their ability to take charge but also trust the RNAs to provide information to fill the gaps they might have from not being present in the OR. This facilitates the anaesthesiologists in feeling part of the team when entering the OR. This contrasts with RNAs, who are physically present throughout the anaesthesia and who care for the patient and can establish a connection with them [13]. Thus, the anaesthesiologists need to be humble with each extubation. This aligns with previous [24] results, showing that the professionals in the OR must cope with the complexity and disturbance, and that they must prepare for and be prepared for any unexpected events, similar to the anaesthesiologists in our study. Our participants, and also other anaesthesiologists in Sweden, are usually responsible for more than one patient at the same time, so they are not able to be in the OR at all times or during all extubations. This in contrast to other countries, such as the UK, Finland, Australia and Germany, where the anaesthesiologists are ultimately the ones responsible for providing anaesthesia without any other professionals specialising in anaesthesia in the OR [9]. Being the leader of the anaesthesia team does not mean that they must perform each extubation. As unexperienced professionals, anaesthesiologists need more practice and are more frequently the ones performing the extubation, while the more experienced anaesthesiologists can see the advantage of taking a step back and taking in impressions, using their ability to combine inputs, assemble sensibilities and look beyond the monitors, similar to the information processing skills necessary in the intensive care unit, where analytical thinking skills are used to gain an overview of the patient’s clinical condition [34]. According to the WHO World Federation of Societies of Anaesthesiologists [35], the anaesthesia process should be led or at least overseen by an anaesthesiologist. However, the traditional model of working within medical specialty silos creates gaps in knowledge and care. A multidisciplinary team-based care model should be embedded in clinical anaesthesia care to enhance patient safety [1], in this case, complication-free extubation.

In this qualitative study, our intention was not to generalise or compare between settings or individuals. However, as for its clinical implications, this study places a focus on the experiences of anaesthesiologists who make decisions and perform extubation on a daily basis in clinical practice. Revealing how anaesthesiologists assemble sensibilities, beyond the information provided by the monitors, may contribute to a greater understanding of this complex and critical moment for inexperienced anaesthesia providers and also influence a change in culture in the OR when it comes to the extubation. This understanding can also contribute to a reduced risk for complications and an increase in patient safety.

**METHODOLOGICAL CONSIDERATIONS**

Our study, with its qualitative design, is appropriate for gathering experience from participants, and, by using an inductive approach, the analysis and results emerge from patterns and variations in the data, not from theory [16]. Consecutive sampling is an adequate method of recruiting from the accessible population, meeting the inclusion criteria over a specific time [36], that is the days on which the interview took place. The variation in ages and number of working years of the anaesthesiologists, and the fact that several hospitals were included, strengthened our study by contributing to a variety of aspects, increasing the credibility of the results [16]. However, the imbalance between genders may be a limitation. In this qualitative study, we did not intend to compare between the genders, nor to generalise, but we have found similarities in the gender balance of other studies dealing with teamwork in the OR [33]. Qualitative methods and content analysis are appropriate for describing people’s experiences, and for achieving trustworthiness [19]. Using a systematic approach to analysing the data, ensuring that the meaning units responded to the aim, and using representative quotations from the transcribed text in the results, strengthened the credibility of our study, as does the detailed description of the analysis process [37]. The first author, who performed the interviews, is an RNA, which may have affected the study results in being influenced by her own experiences, but she was not familiar with any of the anaesthesiologists and, in the process of analysing the data and coming to a consensus about the results, all authors were involved.

**CONCLUSION**

The anaesthesiologists’ decision-making regarding the process of extubation does not rely solely on monitoring signs. Rather, the anaesthesiologists in our study described how, drawing on their experience, they know the advantage of looking beyond the monitors and, by being receptive to inputs from the patient and other professionals, their experience and intuition guides them through the process of extubation, a process they know is unpredictable and where the patient is in a vulnerable state.
CLINICAL IMPLICATIONS

The focus of this study, described by those performing and making decisions on the extubation in clinical practice, will contribute to a greater understanding of the anesthesiologists’ experiences and the strategies they adopt in the process of extubation. The findings also respond to a gap in the literature relating to an important role within an interdisciplinary team that has had very little attention in the evidence. It will also contribute to both education and clinical practice by highlighting the need to place a greater focus on this critical moment, which will reduce the risk of extubation-related complications related to the extubation and thereby increase patient safety and enhance person-centred care.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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AUTHOR CONTRIBUTION

All authors involved in decisions relating to the design of the study, in the process of creating subcategories and categories, manuscript writing, and approved the final submitted version. The first author performed all interviews. The first and last authors involved mainly in responsible for analysing data and to achieve consensus.

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