

Key Factors for Successful General Anesthesia of Obese Adult Patients

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Purpose: To study nurse anesthetists' experiences of key factors for successful airway management in general anesthesia of adult obese patients.

Design: The study was a qualitative observational study with a descriptive approach.

Methods: Eight semistructured interviews were conducted. Data were analyzed using the critical incident technique.

Findings: Five key factors for successful general anesthesia of adult obese patients were identified. These factors were preparing and planning the anesthesia, optimizing patient position, optimizing ventilation through proper preoxygenation and increasing positive end-expiratory pressure, quickly securing the airway, and working in teams.

Conclusions: Knowledge of key factors that facilitate and improve the anesthesia care of obese patients is important to provide safe and quality anesthesia to this patient group as obese patients often have small margins and urgent situations can quickly arise. This knowledge enables the nurse anesthetist to be one step ahead and to be ready to take action if complications occur.

Keywords: obesity, general anesthesia, anesthesiologic nursing, critical incident technique.

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OBESITY IS AN INCREASING PROBLEM worldwide and has increased threefold since the mid-1970s.¹ In Sweden, obesity has doubled between the mid-1980s and the beginning of the 2000s, and 51% of the population is now considered overweight.² Obesity can lead to difficulties associated with anesthesia. These difficulties may include dif-

ficulties in securing the airway and an increased risk of aspiration. A body mass index (BMI) greater than 40 implies a 13% higher risk of difficult intubation.³ These conditions can be further complicated if the patient also has a short neck, big tongue, high standing larynx, small gap ability, and motion constraints.⁴ According to Hodgson,³ obesity implies an increased risk of comorbidities that can affect anesthesia, and it is important for the staff to be aware of the patient's health condition to anticipate possible difficulties during anesthesia. Adams and Murphy⁴ describe the importance of always assessing the airway before anesthesia by examining the patient's head and neck mobility, jaw movement, and ability to open the mouth, as well as inspecting the oropharynx. To facilitate both ventilation and intubation, it is recommended to elevate the upper part of the body so that neck and head, sternum, and ear canal are in line during both induction and extubation.⁵ Overweight leads to a decrease in expiratory residual volume and functional residual volume of the

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lungs, but also to high intrathoracic pressure, which may cause atelectasis and a mismatch between ventilation and perfusion, which can lead to hypoxia.⁶ In cases of obesity, increased oxygen consumption and higher production of carbon dioxide as a result of increased metabolic activity are also described. Horizontal position during anesthesia may further impair functional residual volume and degrade gas yield.^{4,7}

Approximately 10% to 20% of patients with a BMI greater than 35 suffer from obstructive sleep apnea syndrome (OSAS) that may be exacerbated by anesthesia and opioids. OSAS is also associated with increased difficulty in laryngoscopy.⁸ OSAS can lead to collapse of the upper airways resulting in airway obstruction. Fatty tissue in the gum and throat increases the risk of collapse and apnea under the influence of anesthetic agents and opioids. These areas are kept in an alert state because of muscle tone, and muscle tone disappears during anesthesia.⁷ According to Adams and Murphy⁴ the tongue is often enlarged in obese patients, which can lead to total obstruction of the airways during relaxation. Being overweight or obese causes cardiac output and blood volume to increase, although the blood volume is only about 45 mL/kg in obese patients compared with 70 mL/kg in a normal-weighted patient. Symptomatic activity is also increased in obese patients, leading to increased hemodynamic instability.⁵ There has been some discussion as to whether obesity implies an increased risk of reflux and aspiration, mainly during intubation and extubation. Although there is no clear evidence, obese patients are still believed to be at increased risk of aspiration. Awake intubation or rapid-sequence intubation (RSI) is sometimes recommended, as well as awake extubation.^{3,4} Obesity leads to physiological changes that, in turn, can lead to changes in the distribution, binding, and elimination of drugs. There is an increased risk of toxicity if drugs are dosed according to actual weight instead of ideal weight, especially when using narrow therapeutic index drugs.⁷ Half-life, especially of fat-soluble drugs, may also be prolonged in obese patients.⁵

Perioperative nursing includes both practical and medical knowledge about conditions, interventions, and communication with patients. However,

nursing also demands ethical awareness. Ethical competence is a prerequisite for a good and safe care.⁹ The International Council of Nurses Code of Ethics for Nurses¹⁰ forms the basis for the function and duties of the nurse anesthetist. This code clarifies the responsibility of the individual nurse anesthetist to prevent, treat, and alleviate suffering throughout the perioperative phase. This includes carrying out anesthesia based on the individual patient's specific conditions and needs. Because of a high-tech and sometimes stressful environment, there is a risk that the relationship between the anesthetic nurse and the patient will suffer.¹¹ According to Mold and Forbes,¹² obese patients often experience stigma and discrimination, also within the health care setting. Feelings of stigmatization, vulnerability, and shame are common in this patient group.¹³ These experiences can prevent persons with obesity from seeking care. Because many obese patients have experiences of being humiliated in health care contacts, the staff in an operating department have an important role to play in preventing this happening.¹⁴ The nurse anesthetist should pay attention to how the individual patient experiences the encounter with health care, and has an obligation to be ethically competent. Nurse anesthetists have an important task in responding to persons with obesity in such a way that every patient feels calm, confident, and involved. To achieve this, it is important to respect the patient's integrity so that their privacy is not violated.¹²⁻¹⁴

Obesity is increasing in society and therefore increasingly common within anesthetic care. Obese patients often feel stigmatized and humiliated during health care contacts, which places demands on the nurse anesthetists' ability to care for these patients. Obesity implies increased risks during anesthesia, and knowledge about how these risks can be prevented and treated is important to increase patient safety and provide high quality care. Nurse anesthetists' clinical experience of general anesthesia of obese patients constitutes a valuable contribution to the study of successful and safe management of anesthesia in obese patients.

The aim of this study was to study nurse anesthetists' experiences of key factors for successful airway management in general anesthesia of adult obese patients.

Methods

Design

The study was a qualitative observational study with a descriptive approach. The study was conducted using the critical incident technique (CIT) as described by Flanagan.¹⁵

CIT is a method used to analyze behavior in specific situations. This method was chosen as our intention was to study nurse anesthetists' behavior to ensure successful airway management in general anesthesia of adult obese patients. Unlike other qualitative methods, CIT is focused on solving specific problems more than describing different phenomena.¹⁶ The use of CIT as a method focuses on so-called critical incidents and is used for collecting observations of human behavior to solve practical problems and improve performance and outcomes.¹⁵ A critical incident can be defined as behavior that is decisive for a particular outcome. In this study, the critical incidents are specified as key factors for successful general anesthesia of adult obese patients.

Participants and Setting

The unit manager of an operating department at a hospital in northern Sweden was asked for permission to conduct the study and gave a written approval to participate in the study. Only elective surgery is conducted in this hospital. Patients are of American Society of Anesthesiologists (ASA) Physical Status Classification 1 to 4, and all patients are medically optimized and relatively stable before the surgery.

The selection of study participants was purposeful, and participants matching the selection criteria were invited to participate in the study. The selection criteria were nurse anesthetist with at least 2 years of experience in providing general anesthesia, working in the operating department, and willingness to participate in the study. All nurse anesthetists who met the inclusion criteria were invited to participate in the study. A total of 12 nurses were invited to participate, eight of whom were willing to participate in the study. The study participants had an average age of 49 years. The average years of working as a nurse and as an anesthesia nurse were 25 and 15 years, respectively.

Data Collection

The interviews were semistructured, and a pilot interview was conducted to make sure that the questions in the interview guide were understood and in accordance with the study aim. The pilot interview did not lead to any changes to the questions guide, and was included in the study. Interviews were conducted at the participants' workplace by agreement with the nurse anesthetists. The interviews took place in a calm and safe environment, without interruptions. The interviews were conducted during March 2018, were voice recorded, and took from 4 to 10 minutes to complete.

When using CIT as an analytical method, it is not the number of interviews but the number of critical incidents that determine whether the collected material is sufficient.^{15,16} According to Flanagan,¹⁵ between 50 and 100 incidents are required to achieve a credible result. A total of 97 critical incidents were identified during the interviews in this study.

Data Analysis

Data analysis took place in three steps, in accordance with the methodology described by Flanagan.¹⁵ In step one, a reference frame was formulated. The reference frame in this study was key factors for successful general anesthesia of adult obese patients. In step two, the critical incidents that corresponded to the aim of the study were extracted and data were grouped and labeled in accordance with its content. The data were categorized in several steps and categories were revised as needed. The analysis went back and forth until mutually exclusive final categories were formed (Table 1). In the third and last step, the specificity of the data, that is, how the data were to be reported, was determined. This study provides a broad, general description of the analysis results.

Ethical Considerations

This study did not concern personal health, and was conducted as a part of a 1-year master's level graduate work and is therefore exempted from the Swedish Ethical Review Act (SFS 2003:460). However, the project underwent local ethical review at Luleå University of

Table 1. Subcategories and Final Categories

Subcategories	Final Categories
Have equipment and drugs ready	Preparing and planning the anesthesia
Be well informed	
Be aware of risks	
Have a plan A, B, and C	
Control risk factors	
Take in airway aids when needed	Optimizing patient position
Raise the head end	
Optimize patient position	
Preoxygenate	Optimizing ventilation
Increase ventilation/PEEP	Quickly securing the airway
Lung recruit if necessary	
Do rapid-sequence intubation	
Intubation is safest	
Secure the airway quickly	Working in teams
Work together with an anesthesiologist	
Never be alone	

PEEP, positive end-expiratory pressure.

Technology and was approved. The study was planned in accordance with the ethical principles of the Belmont report.¹⁷ All participants and the unit manager of the surgery department received both written and oral information about the study's aim and procedures, and gave written consent to participate in the study. Participation was voluntary, and confidentiality is ensured through anonymized presentation of the study findings.

Results

Five key factors for successful general anesthesia of adult obese patients were identified: (1) Preparing and planning the anesthesia, (2) optimizing patient position, (3) optimizing ventilation, (4) quickly securing the airway, and (5) working in teams.

Preparing and Planning the Anesthesia

Participants emphasized the importance of being well prepared and planning their anesthesia carefully when dealing with an obese patient. Participants had experienced that obese patients were at greater risk of being respiratory and circulatory unstable, and that there is an increased risk of a difficult airway. The importance of reading up on the patient and reviewing their medical records

to see if any previous anesthesia has resulted in any problems was also emphasized.

See if there is any previous note if they have been anesthetized earlier, if there were any complications then. Looking up previous anesthesia records (Nurse anesthetist 4).

Participants were well aware of the increased risk of a difficult airway associated with obesity and the importance of checking the patient's physical status both preoperatively at the preadmission testing assessment and when they enter the operating room to identify airway problems and perform standardized preassessments. These preassessments were gap ability, Mallampati classification, and neck appearance and movement.

To check that they can open their mouth properly and they are not stiff in their neck (Nurse anesthetist 5).

Checking if they have reflux ... which is common in obesity (Nurse anesthetist 1).

All participants emphasized the importance of using airway aids in various forms in case of suspicion of a difficult airway. It was considered important to ensure that aids such as oropharyngeal airways in different sizes and trachea tube leaders were

always in the room and that a Glidescope was near to hand for use in case of a difficult airway. It was also considered important to line up the equipment and have the aids close to hand, and also to know where the difficult airway trolley and the bronchoscope were and to use these if necessary.

I will use the Glidescope at the slightest suspicion that it is a difficult airway (Nurse anesthetist 5).

...make sure I have everything I need to manage the airway, different sizes of oropharyngeal airways (Nurse anesthetist 8).

Some participants considered it important to be aware that obese patients were at higher risk of complications during general anesthesia. Preparing and planning also included having readiness for action and the flexibility to change the anesthesia method if necessary.

In addition to plan A, I have a plan B and a plan C ... the risk is significantly greater that I have to convert my anesthesia, from a laryngeal mask to an intubation (Nurse anesthetist 3).

...above all being well prepared and having considered possible scenarios... It needs to be carefully planned (Nurse anesthetist 6).

Optimizing Patient Position

During the interviews it became evident that a key factor for successful anesthesia of obese patients was optimizing the patient's position before induction. This might involve, for example, tilting the head of the operating table slightly so that the pressure from a possibly large abdomen is decreased, giving the lungs more a better chance to work optimally. It was also described as important to ensure that the patient was lying on a soft and comfortable operating table to reduce the risk of pressure injuries because of body weight.

...tilting enough to reduce pressure on the chest for the sake of the airway... make sure to optimize the patient's position even before induction so that they are well on the operating table (Nurse anesthetist 8).

...pressure ulcers and so on ... there are so many injuries that can occur both on the skin and on the nerves ... that's important to keep in mind (Nurse anesthetist 2).

Optimizing Ventilation

Optimizing the ventilation before and during the anesthesia of obese patients was described as important. This could be done in a number of ways. Before the patient is induced, proper preoxygenation was considered important to charge the patient with oxygen before the waiting airway management and the apnea period. This is because obese patients quickly lose oxygenation due to impaired functional residual capacity in the lungs.

The airway and oxygenation can be a major concern ... I preoxygenate significantly longer on an overweight patient ... because they usually have very poor reserve capacity (Nurse anesthetist 3).

They lose saturation much faster than a normal weight patient. So if you're having trouble keeping a free airway, they lose saturation much faster and you have a considerably shorter time to fix that problem (Nurse anesthetist 8).

Another way to optimize ventilation in obese patients was to increase the positive end-expiratory pressure (PEEP) to ventilate optimally. Lung recruitment during surgery could also be necessary if it was difficult to keep saturation, or if atelectasis occurred. Participants expressed that these complications occurred more often in obese patients compared with persons of normal weight.

Sometimes you have to put on a lot of PEEP ... because sometimes they lose saturation quite quickly and you may have to lung recruit them, and PEEP 8 is not unusual for this patient group (Nurse anesthetist 5).

... there is a greater risk of atelectasis during surgery, so you need to be ready to lung recruit during the surgery (Nurse anesthetist 3).

Securing the Airway Quickly

Participants stressed the importance of rapidly securing a free airway, preferably by intubating

as quickly as possible, preferably using RSI. This was to reduce the risk of aspiration, but also to quickly achieve a free airway and to ventilate the patient.

Do an RSI right from the start. Instead of struggling with a mask (Nurse anesthetist 8).

...perform an RSI, be sure to get the tube down as soon as possible, to ventilate them. Secure the airway! (Nurse anesthetist 1).

For general anesthesia of obese patients intubation was preferred because it was considered a safer airway compared with a laryngeal mask. Use of a laryngeal mask was considered to entail greater risk of aspiration; it was also considered more difficult to get the mask to fit tightly with obese patients.

It's no use to use laryngeal mask if they are overweight, just forget about it. Intubation is the first choice (Nurse anesthetist 5).

Working in Teams

An important key factor was to never be alone in the induction of an obese patient. At least two nurse anesthetists should work together to ensure readiness to manage problems associated with intubation. Helping each other in the team was considered important for a successful procedure. At the slightest suspicion that it could be difficult to intubate, an anesthesiologist should be called to the operating room before intubation. In the case of suspicion of difficult intubation, especially in severely obese patients, the most experienced in the team should be at the forefront and staff with the right skills should be in place.

You need to have the right staff in place, you do not induce by yourself, you take help from an experienced anesthetist ... (Anesthesia Nurse 6).

Discussion

The aim of this study was to study nurse anesthetists' experiences of key factors for successful airway management in general anesthesia of obese adult patients. Five key factors were identified: preparing and planning the anesthesia, opti-

mizing patient position, optimizing ventilation, quickly securing the airway, and working in teams.

Participants emphasized the importance of careful preparation and planning. Being aware of the risks associated with the induction of obese patients was highlighted as an important part of the preparation. According to Goode and Philips¹⁸ it is important that anesthetic staff understand how positioning, blood volume, cardiac output, airway management, and pharmacokinetics differ between obese and normal weight patients to provide safe and qualitative care.¹⁸ If the anesthetic staff have the right knowledge and are aware of the risks associated with anesthesia, this leads to safer and better care for the patient.¹⁹ Several participants in the study pointed out that it is important to be aware of the risks and difficulties associated with intubation and anesthesia induction of obese and overweight patients. They also described that the laryngeal mask was almost impossible to use. However, it is also argued that there is no correlation between high BMI and difficult intubation, and that difficulties depend on other factors.^{7,20}

The participants in this study mentioned the importance of good positioning of the patient before induction. Positioning was described as important to reduce the risk of pressure injuries and ulcers because of body weight. It was considered an important task in perioperative care to ensure that the patient is positioned well and that the mattress and other substrates are chosen and adjusted according to the size and weight of the individual patient.²¹ Raising the head was described as important as it reduced the pressure from the abdomen, thus optimizing ventilation. According to Adams and Murphy,⁴ a horizontal position during anesthesia may impair the functional residual volume of the lungs, which reduces gas yield. Hodgson³ and Huschack et al⁵ also state that good positioning of the patient with an elevated head and a jaw lift is important to avoid respiratory problems during anesthesia and to facilitate intubation and patient ventilation. An elevated head was seen as a key factor as it reduced the risk of aspiration during induction. However, Hodgson³ and Adams and Murphy⁴ argue that the notion of increased risk of

aspiration in obese patients is based solely on the results from a single study from the 1970s, and thus lacks reliability.

Proper preoxygenation was seen as an important part of optimizing ventilation in obese patients. One participant claimed that preoxygenation of up to 8 minutes could be required. However, there are indications that it is not the length of the preoxygenation that increases end-tidal oxygen fraction FeO_2 . Instead, providing a positive pressure of 4 cm H_2O throughout inspiration and expiration during preoxygenation has been found to be beneficial with regard to FeO_2 in obese patients.²² According to Dixon et al²³ an elevated head end of 25° during preoxygenation gives a 23% longer apnea tolerance in anesthesia induction in patients with a BMI more than 40. The amount of atelectasis that occurs during general anesthesia correlates with the patient's body weight. In normal weight patients a PEEP can reduce the risk of atelectasis; however, this is not sufficient at higher BMI. In obese patients, PEEP needs to be used in combination with lung recruitment to reduce the risk of atelectasis and improve oxygenation.²⁴ In our study, optimizing ventilation was seen as important for successful general anesthesia. Recruitment could be necessary during surgery to maintain good ventilation, and increased PEEP may be necessary to increase oxygenation and improve ventilation. However, none of the participants mentioned the combination of PEEP and lung recruitment as a possible strategy. The importance of quickly securing the airway was stressed, including using RSI. They also argued that intubation was the safest method of general anesthesia of obese patients. Adams and Murphy⁴ argue that securing the airway using a tracheal tube is the first choice in the induction of obese patients. If traditional laryngoscopy proves difficult, methods such as RSI, awake intubation, or intubation with different types of fiber optics can be used.

Teamwork was described as a key factor for successful anesthesia of obese patients. Huschak et al⁵ emphasize the importance of competent teams who put the patient at the center and have good knowledge of the needs connected to this patient group. According to Huschak et al⁵ there is a risk of team members fostering negative attitudes toward obese patients and assuming in advance that

induction and anesthesia will be difficult. Valeberg et al¹¹ state that staff can influence attitudes toward patients in the operating room by making derisive or condescending remarks. Moreover, the anesthetic staff can affect how the patient experiences anesthesia by how they communicate. Speaking in positive terms can give the patient a more positive experience and, in contrast, speaking negatively can cause the patient to become stressed and worried.²⁵ According to Wacker and Kolbe,²⁶ teamwork is important in anesthesia care, but in urgent and difficult situations, there is also a need for clear and concise leadership, as well as good communication between the team members. Leadership was not explicitly mentioned in this study; however, the importance of having the right people in the right place in the event of urgency was emphasized. The most experienced in the team should be at the patient's head to secure the airway as fast and efficiently as possible.

Many people with obesity are restricted in their daily lives because of reduced health and quality of life. This may involve impaired ability to be physically active without pain. Negative experiences of discrimination and stigmatization can contribute to impaired self-esteem and social isolation. The language used perioperatively is important, and by adopting a positive attitude, the patient can have a better experience. This implies, for instance, avoiding directly remarking about equipment being too small and, instead, communicating with more neutral expressions, such as "we'll use this one" or "let's use a number (x)" when referring to equipment sizes.⁴ According to the Code of Ethics for Nurses¹⁰ an important part of nursing is to reduce suffering, and being sensitive and attentive to what the patient perceives in the situation at hand. Important parts of anesthesia care include involving the patient in decisions about their care, not exposing the patient's body unnecessarily, and safeguarding the patient's integrity.¹¹

Strengths and Limitations

CIT is used to gather important information about human behavior in predefined situations.^{15,16} Data were collected using semistructured interviews, and the questions were formulated to suit the purpose of the study. To achieve validity, a pilot interview was conducted to ensure that

the questions posed during the interviews corresponded to the purpose.

Reliability implies the stability of the data collected.²⁷ If our question guide were to be reused we consider that there is a high likelihood that similar, if not identical, responses from other nurse anesthetists would be obtained. All interviews were transcribed verbatim and read through by the authors several times. All categories were formulated with the intention of remaining as close as possible to the transcribed text. The categorization process was discussed among the authors to ensure triangulation of the data. Quotes from the transcribed interviews were included in the **Results** section to reinforce the interpretation of the data.

The selection of study participants was purposeful to obtain participants with relevant knowledge and experience of general anesthesia of obese patients. All participants in the study work in the same hospital where only elective operations are conducted, which forms a relatively homogeneous group. One limitation is that although the findings reflect the nurses' actions, nurse and patient feelings and attitudes are not explored. The inclusion of nurse anesthetists working in emergency care could also have contributed to greater variation in critical incidents collected.

Conclusions

Five key factors for successful general anesthesia of obese adult patients are identified: These are preparing and planning the anesthesia, optimizing

patient position, optimizing ventilation, quickly securing the airway, and working in teams. This study shows that general anesthesia of obese patients requires preparation and planning as this patient group often has small margins and urgent situations can quickly arise. The nurse anesthetist and the team working around the patient need good knowledge not only about the medical risks but also which measures to take to provide safe general anesthesia. Knowledge of key factors for a successful general anesthesia of obese adult patients enables the nurse anesthetist to be one step ahead and to be ready to take action if complications occur. Studies have shown that obese patients often feel stigmatized and sometimes poorly treated by health care professionals. More in-depth interviews and qualitative studies are required to further explore how anesthesia treatment and care of obese patients can be improved.

The results of the study clarify and highlight successful strategies for general anesthesia of obese patients. The anesthetist nurse and the rest of the team involved in the care should be well prepared, optimize the patient's position and ventilation, and work in teams to quickly secure the airway. A good knowledge of the circulatory and respiratory effects of anesthesia on obese patients is important to be able to modify the anesthesia care according to the individual needs of the patient.

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