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DOI: 10.1080/17415349.2020.1795027

Nursing considerations for anaesthesia of the obese patient

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ABSTRACT: Obesity increases anaesthetic risk due to associated co morbidities. Obese patients present a unique set of considerations in the peri- anaesthetic period including drug administration, positioning, changes in monitoring and recovery. Management of stress is key in order to provide the most appropriate care in the pre and post anaesthetic phases. In general, they are likely to have reduced cardiovascular function and are at risk for hypoventilation. It may be prudent to have the patient complete a weight loss regime prior to anaesthesia for routine procedures to reduce anaesthetic risk.

Keywords: nursing; obesity; anaesthesia; hypoventilation; cardiovascular

Pre-anaesthetic period

Many of the typical problems that are encountered with nursing patients in a clinical environment are related to stress (Vine, 2019). Stressed and anxious patients may struggle during handling, resent treatment, react with aggression, or show signs of frustration such as vocalisation or bar chewing (Scarlett, 2019). Obese patients may be more likely to resent handling as they often display signs of dyspnoea due to excess pharyngeal tissues and fat around the neck and chest, resulting in narrowed respiratory structures. These patients may have concurrent disease processes, for example osteoarthritis (OA) which can further increase difficulty in handling and stress management due to pain. Low stress, minimal and sympathetic handling techniques alongside accurate interpretation of body language can help to offset stressful or painful restraint experiences (Scarlett, 2019). Environmental management such as temperature and noise control, non-slip mats for floor examination, and mattresses or padding for kennels have a positive influence on the hospitalisation experience. Obese patients are prone to hyperthermia (Bruchim et al., 2006) and steps may need to be put in place to counteract this, for example, a larger kennel or fan.

Pre anaesthetic assessment of obese patients can prove challenging when attempting to auscultate the lungs and heart; stress or hyperthermic induced panting can make it difficult to hear and an added layer of fat over the thorax can muffle sounds. The American Society of Anaesthesiologists (ASA) Physical Status Classification System can help to assess and categorise the risk an individual patient poses (Posner, 2016). ASA classification is a useful tool to feed into a plan of nursing care, designed to highlight the needs of an individual patient. Obesity would likely place a patient in grade 2 of the ASA classification system, described as mild systemic disease (Cripwell et al., 2019; Figure 1). However, it is worth bearing in mind that the grading system is purely a guide and should be used as part of the overall assessment of patient needs. Once these needs are highlighted, nurses are fundamental in the preparation of reducing anaesthetic risks for obese patients.

Moving obese patients who are sedated or anaesthetised can prove challenging due to their sheer weight. It is vital to plan the logistics of this process to prevent injury to patients and personnel. Preparation with large slings with handles or non-stretch blankets, tables with adjustable height and additional staff help can assist. Discuss the process with colleagues before any action takes place in order to formulate a plan that everyone involved is comfortable with.

Obesity has implications on drug choice, dosage choice and efficacy. From a nursing perspective it is important to consider how drugs may affect the body in order

ASA Scale	Physical status	Patient examples
1	A normal healthy patient	No underlying disease and not brachycephalic. Undergoing routine surgery such as neuter
2	A patient with mild systemic disease but compensating well	Geriatric patients or young patients (>12 weeks), obese, mild dehydration, brachycephalic otherwise healthy
3	A patient with severe systemic disease, not fully compensating	Very young patients (<12 weeks), moderate dehydration, brachycephalic with mild respiratory or gastrointestinal signs, uncontrolled epilepsy
4	A patient with severe systemic disease that is a constant threat to life	Severe dehydration, brachycephalic with moderate/severe respiratory or gastrointestinal signs, status epilepticus, severe anaemia
5	A moribund patient who is not expected to survive without treatment	Advanced/decompensated; shock, renal disease, hepatic disease, endotoxemia, cardiac disease
E	The addition of the letter E to a grade signifies an emergency, when a delay in surgery would cause a significant increase in threat to life or body part	-

Figure 1. ASA physical status classification system adapted from Cripwell et al. (2019).

to foresee and prepare for issues arising (Waring, 2017). Sedative drugs such as alpha 2 agonists or sedative effects from opioids may exacerbate pre-existing respiratory conditions as they may cause respiratory depression or panting (Grubb, 2016). Obese patients are more likely to suffer from airway dysfunction or tracheal collapse than patients with an ideal body condition score (BCS) (Linder, 2015) and therefore should be closely monitored after administration of premedication drugs. Perfusion to excess adipose tissues is poor, affecting drug distribution and effect when administered subcutaneously (Scales & Clancy, 2019). Often this is done by accident in obese patients when the intention was for intramuscular route. It may be more appropriate to select a longer needle and/or assess which muscle group has less coverage of fat. Repeated attempts to sedate patients is likely to result in a prolonged preanesthetic period and further stress for the patient.

The veterinary surgeon may prescribe drugs based on actual body weight or an estimate of lean bodyweight dependant on how lipophilic a drug is. This subject is still somewhat controversial, and some veterinary surgeons may choose to administer all drugs based on lean bodyweight. It can often be helpful for accuracy to ask a second opinion on an estimate of lean bodyweight or look back at a patient's history for a time where they were given an ideal BCS.

The ideal premedication protocol would allow the patient to tolerate a facemask for the purposes of oxygenation immediately prior to and during anaesthetic induction. The main aim of preoxygenation is to raise the concentration of oxygen within the alveoli to help prevent desaturation in a period of apnoea (Grubb, 2016). Many of the drugs used for induction of anaesthesia have the potential to cause apnoea. A tight fitting facemask is the most effective, however, care must be taken to ensure that flow rates are high enough to prevent rebreathing. This is not as much of an issue with looser fitting masks, however, they are not as effective. Preoxygenation should ideally occur for a minimum of three minutes before induction agent is administered (Downing & Gibson, 2018). Try to have patients positioned in sternal recumbency (Figure 2) where possible to assist in appropriate ventilation. The head should be slightly raised by placing onto a folded towel to prevent airway obstruction prior to securement of the airway.

Figure 2. An anaesthetised patient with a BCS of 8/9 positioned for surgical preparation. Permission obtained from R(D)SVS.

When preparing equipment for securement of the airway and maintenance of anaesthesia, it is important to consider the estimated lean body weight of the patient. A range of endotracheal (ET) tubes should be selected as the patient may have a smaller than expected trachea in relation to weight. Equipment for an anticipated difficult intubation should be prepared. Patients that have been panting or vocalising excessively may have an inflamed and swollen laryngeal area which can make for a more difficult intubation. A laryngoscope with suitably long blade and bougie or dog urinary catheter are useful. Cuffed ET tubes should be selected so that a seal can be made in the trachea to provide good quality intermittent positive pressure ventilation (IPPV) if needed. The use of ET tubes with cuffs in cats is a debated issue due to the fear of tracheal damage (Hughes, 2016), and it is often down to practice or anaesthetist preference. When selecting a breathing system and calculating fresh gas flow (FGF) rates it is important to base tidal volume on lean weight as not to overinflate the lungs when providing IPPV either by hand or by mechanical ventilation. Ideally a breathing system which supports IPPV and is suitable for the patients lean bodyweight would be used, such as Ayres T- Piece or Bain.

Anaesthetic period

In order to explore the differences in anaesthesia of an obese patient vs a patient of a an ideal BCS it is important to understand the alterations that obesity poses on respiratory and cardiac physiology.

Obesity may have an influence on the following:

- Pulmonary atelectasis – the collapse or partial closure of respiratory tissues including the lung or alveoli. Anaesthetised patients are at risk of atelectasis and obese patients even more so.
- Ventilation/Perfusion (V/Q) mismatch – where there is ventilation without perfusion or vice versa. Obesity can cause compression of vessels, plus atelectasis, so this often means that alveoli are ventilated but there is disrupted blood supply.
- Decrease in chest wall compliance – the mass of excess adipose tissue around the thorax and abdomen means that it can be harder for the chest wall to expand.
- Decrease in pulmonary compliance – lungs are less able to stretch and expand.
- Decrease in lung volume- a reduction in total lung capacity.

- Decrease in functional residual capacity (FRC) – FRC is the volume of gas left in the lungs after expiration to allow gaseous exchange to continue between breaths. This decrease seen in obese patients means there is less tolerance of periods of apnoea before desaturation occurs.
- Decrease in cardiac index (CI) – the CI measures performance of the heart in relation to size. It measures the cardiac output (CO) from the left ventricle in association with body surface area (BSA). Heart performance is poor in obese animals.

Pulse oximetry is useful in detecting hypoxaemia, however, it does have limitations in providing information on how well a patient may be ventilating as it does not provide information on quality of respirations (Rigotti & De Vries, 2011). An anaesthetised patient does not have to be ventilating particularly well in order to have an appropriate saturated oxygen (SpO_2) as the fact they are often in receipt of 100% oxygen will mean that haemoglobin is maximally saturated even with poor quality respirations.

Capnography is particularly useful in the prompt assessment of metabolism, circulation and ventilation, as it provides an end tidal carbon dioxide ($ETCO_2$) reading and a wave form (O'Dwyer, 2015). The use of opioid and sedative drugs, and anaesthetic inhalants can act as a respiratory depressant. This is especially important to consider in obese patients where there is already increased risk of hypoventilation. Tachypnoea is common and this results in poor gas exchange with inadequate filling and emptying of the lungs. Hypocapnia can also be common as tachypnoea causes the patient to excessively loose carbon dioxide (CO_2) (Figure 3).

Obese patients may be more prone to intra-operative dysrhythmias, potentially precipitated by anaesthetic agents which inadvertently promote cardiorespiratory depression (Dugdale, 2011). If the patient is tolerant it can be helpful to attach ECG leads so that the waveform can be assessed during induction of anaesthesia. A good opportunity to do this is when the patient is receiving pre anaesthetic oxygenation.

It can be challenging to measure blood pressure in obese patients. Invasive blood pressure can be difficult to achieve as superficial arteries may be obscured by fat when attempting to place an arterial cannula (Dugdale, 2011). This can also be problematic for oscillometric blood pressure devices that are reliant on pressure sensing for measurement. It may be most appropriate to use a doppler alongside a manually operated sphygmomanometer if available. The doppler probe can be taped in place to facilitate multiple readings over a period of time. Hypertension is common in obese patients (Boland, 2014), however, the vasodilation effects of commonly used anaesthetic agents may counteract this.

Post-anaesthetic period

Additional weight within the abdomen may increase pressure on the great vessels (aorta, vena cava and pulmonary artery/vein) when placed in dorsal recumbency, therefore, repositioning should be done slowly. It can be helpful to move into sternal recumbency while the patient is still anaesthetised so that capnograph trace can be assessed and IPPV can be performed while the patient is still intubated if necessary. Positioning aids in the kennel can help the patient stay placed in sternal recumbency and a slightly raised head position, as the same in the pre anaesthetic period, can be useful in preventing airway obstruction (Scales & Clancy, 2020). Positioning aids can also be helpful to alleviate pressure on the hips and elbows as patients with OA may not find a frog legged position comfortable. Pulse oximetry is extremely useful in the post-anaesthetic phase to make sure that patients are saturating adequately on room air, pre and post extubation. If there is a decline in $SpO_2 < 95\%$ oxygen supplementation may be required (Poli, 2016). Due to increased oxygen demand in obese patients, any steps to prevent further increase in demand should be considered. Hypothermia induced shivering should be counteracted with active warming, however, care should be taken to try and prevent overheating or panting.

Conclusion

This article has highlighted some of the issues that may be apparent in providing peri-anaesthetic care to obese patients.

Supplemental Material

Supplemental data for this article is available online at https://doi.org/10.1080/17415349.2020.1795027.

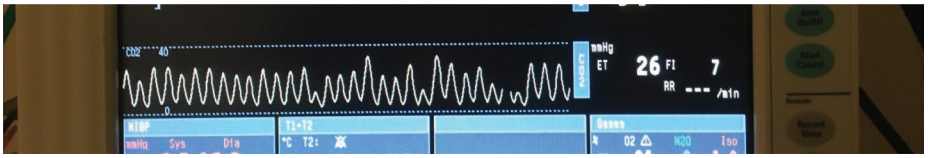

Figure 3. A capnograph trace indicating hypoventilation with tachypnoea. Capnometry showing hypocapnia. Permission obtained from R(D)SVS.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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