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Bariatric Surgery – Anesthesiologic Concerns

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1. Introduction

Both in developed and under developed countries the total number of obese people and their fraction of the population are increasing, and they live longer. The need for bariatric surgery is rapidly increasing (Buchwald, 2009) and the concept of fast-track surgery and laparoscopy (Kehlet, 2008) has made bariatric surgery a cost-effective and efficient way of treating the morbididly obese when other non-surgical options have been unsuccessful. Whereas ambulatory care is evolving for medium invasive bariatric procedures (i.e. gastric banding or minor laparoscopic procedures) in some places, most bariatric patients are still in-patients, although a short stay and accelerated recovery should be feasible and encouraged (Raeder, 2007). There is a general trend, especially in the obese, to supply anesthetic care with loco-regional techniques whenever possible (Raeder 2010a). This has to do with less physiologic and especially respiratory physiologic, derangement, when loco-regional techniques are used instead of general anesthesia. Also, as ultrasound technology has emerged as a valuable tool in locating regional anesthesia bone-marks in the obese, the use of brachial plexus techniques and spinal/epidural techniques has grown in the obese. Still, the bariatric procedures usually imply an upper abdomen surgical procedure and a predominantly laparoscopic approach. This kind of surgery is hard to do with success and patient satisfaction in the awake, even if they have a perfect spinal or epidural anesthesia. Similarly local anesthesia is not possible to apply sufficiently for laparoscopy, both due to the complexity of anatomical structures involved and the risk of toxicity from high total doses of local anesthetic agents. Still, local anesthesia is a very valuable, many will say mandatory, supplement to general anesthesia in these patients for improved postoperative pain management, together with other measures (see later). There are hardly any reports on bariatric surgery in epidural or spinal anesthesia, but there are a very few scattered reports on use of epidural pain relief for the postoperative period (Kira, 2007; Nishiyama 2011). Considered the technical challenge with these techniques in the obese and the modest pain problems in these patients when a proper multimodal approach is used, almost all anesthesiologist will abstain from using regional techniques in these procedures.

2. Preoperative concerns

Obese patients may present for any kind of surgery throughout their life; minor or major, emergency or elective, well prepared or with severe concomitant problems. Many general precautions and warnings linked to anesthesia in these patients are based on worst case scenario in an unstable and poorly prepared patient. The bariatric patient, although quite huge per definition, is still in many ways less problematic. They are highly motivated, well prepared – often through weeks, they are usually young or middle aged, and they usually understand that their cooperation and own efforts are very important during the recovery phase.

Although the obese has reduced physiologic reserves, both cardiovascular and respiratory; the obesity per se is usually not a major risk factor or reason for not accepting these patients for general anesthesia and bariatric surgery (Dindo, 2003). The rare non-acceptance of these patients has to do with the total picture of obesity, co-morbidity, preparation, co-operation and potential for improvements by postponing the procedure and spend some efforts in medical optimization.

The list of co-morbidity which are more frequent in the obese population include: diabetes, hypertonia, gastro-oesophageal reflux, artrosis and musculo-sceletal pain, sleep apnoea syndrome and in more severe cases pulmonary hypoventilation and atelectasis or heart failure (Chung 1999). It is beyond the scope of this chapter to go in depth with these concomitant diseases; the reader is advised to look in general anesthesia textbooks (Raeder 2010a).

Useful tests are ECG, spirometri, resting bloodgas while breathing room-air, pulmonary x-ray and a functional test, such as walking a flight of stairs.

Baseline blood pressure is important to obtain. Also, a 12-lead routine ECG should be taken in these patients upon age above 40 yrs or any suspicion of cardiovascular disease. Still, many important aspects of the ECG will be displayed anyway on the one-lead routine monitoring peri-operatively. The one-lead ECG is displayed before any drugs are given and will tell you about arrhythmia, P-Q prolongation or heart block and any ST segment changes in the pre-cordial area. What you will miss by a one-lead ECG are signs of heartfailure, hypertrophia and previous infarction.

Body mass index is the most common way of classifying obesity, and this figure is also useful for the anaesthesiologist for classification, risk-stratifying and need of extra consults and measures. However, for dosing of anesthetic drugs, different weight concepts are more useful. Some definitions of weight is listed in the frame below:

Different types of weight:

- Actual weight : = Total weight
- Ideal weight: Height ÷ 100 (105 in women)
- Lean weight: = fat-free body mass
- Corrected ideal weight:
  = ideal weight + 20-40% (?) of difference to actual weight
- Body mass index: weight / height x height

2.1 Concomitant pulmonary disease

Breathing disorders may be classified into problems of airways and lungs, problems with respiratory control and problems of muscular function for breathing. In patients with respiratory problems, especially chronic obstructive disease, it may be useful to refer the patient to a physiotherapist in advance in order to clean up and get instructions on how to cough, breathe and mobilize lungs after surgery.

Patients with an episode of airway infection should generally be postponed until 1-2 weeks after the infection is fully resolved. Postoperative sore-throat or coughing may be a problem being no good for the healing after a bariatric surgical procedure, thus also mild viral symptoms should call for postponing the case.

As with all patients; stop of smoking at least 4-5 weeks before scheduled surgery will improve the respiratory function, and this is especially valuable in the obese because they are more prone to airway problems than others. Also, smoking may impair wound healing. Offering the patients this kind of elective, planned surgery may also be a good opportunity to try to convince patients to stop smoking, and some clinics even put this token of patient cooperation as a condition for being accepted for surgery. Stopping 1-3 weeks before surgery, if the patient is a daily smoker, is not advised; as airway reactivity and secretions may be temporarily increased for some weeks after stop of smoking. If stop of smoking is not possible, they should at least not smoke on day of surgery, as even a single cigarette will result in some carboxy haemoglobin formation which will reduce the oxygen binding capacity of blood for some hours afterwards.

For patients with severe airway or pulmonary disease or infections, a more thorough approach should be undertaken for preoperative evaluation. Patient history with ability to walk one flight of stairs, the amount of coughing and secretion, as well as episodic changes versus stability in condition should be taken. Preoperative lung x-ray, arterial blood gas and spirometry with vital capacity and forced expiratory volume (FEV1), with and without bronchodilator are further options. Generally, a vital capacity of less than 1.5-2 litres in an adult or a FEV1 Less than 1-1.5 liter should indicate increased likelihood of severe problems and need of ventilatory support post-operatively.

2.1.1 Sleep apnoea syndrome (SAS)

Sleep apnoea syndrome is under diagnosed, but probably occurs in 4% of adult male population and 2% of females. It is associated with obesity and also with large tonsils or adenoids, especially in small children, but could be present without any of these (Young, 1993). Although these patients manage someway at home preoperatively the chance of respiratory arrest will be increased especially first night after surgery in general anesthesia or any use of post-operative opioids. Although fatalities are very rare, 8 cases were reported in a big US survey (Lofsky, 2002), one case is one too much and could be avoided by overnight continuous monitoring of respiration, either by pulse-oxymetri or better with respiratory rate monitoring of some kind (see below).

The symptoms of SAS almost always include snoring but should be accompanied with more problems to make the diagnosis: respiratory arrest (> 10 sec), frequent change in

position during sleep, tired in spite of normal "length of sleep", morning headache and family history of SAS (Chung, 2008). A more specific and detailed diagnosis could be made with polysomnography done well in advance, and then eventually fit and become familiar with using a CPAP device. Patients with a CPAP device should be urged to bring this with them on day of surgery, in order to have ready for use in the PACU if needed and mandatory use the first nights.

During polysomnograpy the patient is monitored continuously during full overnight sleep with pulse oxymeter, ECG, number and lengths of apnea episodes etc. More than 30 episodes of hypopnoea or apnea per hour signal a serious condition, whereas less than 15 is mild. A fairly precise prediction of a serious condition could be made clinically if the patient tests positively on these four anamnestic items: load snoring (heard through wall or door), observed apnea during sleep, tired in spite of normal length of sleep in bed, hypertension (Chung, 2008).

A rational approach to these patients may be (table):

Known SAS:

- If treated with CPAP → OK *
- If minor surgery with no opioids postop → OK
- If seriously affected SAS and use of opioids → Continuous respiratory monitor!

Suspected SAS:

- If serious symptoms → polysomnography (or →continous monitor)
- Mild symptoms (not tired, no major apnoea or distress)
  - → OK if not opioid effects after discharge to ward
  - Otherwise: monitor

No SAS mentioned:

- Ask for symptoms, partner/comparent information
- If in doubt → = suspected and plan with monitoring

*It has been shown that SAS patient who use a CPAP will not have increased risk of apnoea, even during first night after surgery.

Importantly, when these patients are considered to be extra risk, ordinary stay at the ward will not be good enough; they have to be monitored continuously during the night. A pulse oxymeter may do, although signs of hypoxia are somewhat delayed, even better is a respiratory rate monitor with alarm of apnoea. Such respiratory rate monitoring may be: end-tidal CO2, breast cage movements or respiratory sound monitor on neck.

2.2 Patients with cardio-vascular disease

Generally; a patient who is unable to climb 1 flight of stairs in normal speed without cardiovascular symptoms (angina or heart failure, dyspnoea), have a recent cardiac event (infarction, revascularisation) within last 3 months or have a serious unstable condition or serious limitation in activity; should be postponed and go to cardiology consult and be optimized before elective surgery.

2.3 General advices and measures in advance

Especially when these intra-abdominal bariatric procedures (laparoscopy, laparotomy) is planned, it is a good safety advice to make the patient reduce even a minor bit in weight during the weeks ahead of surgery, by using a high protein-low carbohydrate diet. The reason is that most obese have an enlarged and fragile fatty liver. By diet and weight reduction for some weeks, the liver will shrink and become less fragile. This may be important in order to facilitate surgical access in the abdomen and reduce the risk of liver tear or bleeding.

In the obese patients gastro-oesophageal reflux disease (GERD) occur in about 20-30% of cases, and these patients may be at risk for peri-operative regurgitation of acid stomach juice into the airways. A good way of reducing both amount and acidity of the gastric content is to use a proton pump inhibitor (e.g. omeprazole or other). The first dose should be at least some hours ahead of surgery, but best if already given the evening before and then repeated on morning of surgery. If this had not been accomplished, some sips of non-pulmonary toxic fluid antacid (sodium-citrate) in front of anesthetic induction may be an alternative solution, although not so effective as a proton pump inhibitor.

As to fasting rules, the gastric emptying speed in obese patients is similar as to lean patients (Soreide, 2005). Thus, if no physiologic cause of gastrointestinal obstruction or slowing is evident, they should have nothing to eat (including milk and milk products) for the last six hours in front of surgery and no clear fluids for the last 2 hours. Still, some preoperative tablets may be allowed in a few sips of water up to 1 hour ahead of anesthetic induction.

2.3.1 Premedication

Due to the increased incidence and risk of airway obstruction in the obese patients, one should generally be restrictive with anxiolytic or opioid premedication. If there is a strong indication, an oral benzodiazepine may be used, either the short acting midazolam (5-7.5 mg orally) or more longacting diazepam, 5-15 mg. The patients should then not be left alone, but have attendance or pulse-oximetry applied. Establishing an IV line in the ward for premedication will enable a more precise targeting of effect, both because midazolam or diazepam may be carefully titrated and also because rapid injection of the benzodiazepine antagonist, flumazenil, is an option if needed for overdosing or respiratory problems. Establishment of an IV line on the preoperative ward is also a good measure in terms of avoiding stress and time consuming search for a vein in the busy operating room (OR) just before start of anesthesia. Whereas the usual veins on the dorsum of the hand may be difficult to find in the obese, the thin volar veins are usually accessible without covering fat pads. It may also be a case for ultrasound location of veins in these patients, either in the elbow or the medial upper arm (basilica vein) or the central veins (internal jugular or subclavian) in the more difficult cases. Opioid premedication should only be used when needed for pre-operative pain, and then in titrated iv doses with subsequent monitoring.

The time for potential premedication, 1-2 hours ahead of surgery, may be a time for giving other drugs of benefit for the patient such as oral analgesics (paracetamol and NSAIDs or cox-II inhibitor) or prophylactic antibiotics or thrombosis prophylaxis. As the obese are

more prone to both thrombosis, pulmonary embolism and wound infections in general, and even more so with intra-abdominal surgery, appropriate antibiotic (e,g. Cefuroxim 1.5g) and antitrombotic (e.g. low molecular heparine 5000IU sc, day before and every day for one week) is usually indicated.

3. Anesthetic technique

3.1 Surgeons contribution

Even though general anesthesia is needed, it is very important that the surgeon use an optimal protocol of local anaesthesia extensive infiltrated in wound areas and surrounding structures (LIA-technique) in order to reduce postoperative opioid consume. The surgeon should typically use a total of 40 mls of either bupivacaine 2.5 mg/ml or ropivacain 2.0 mg/ml for superficial and deep wound infiltration. If more than 40 ml is needed, ropivacaine should be the drug of choice, as the toxicity from general absorption is less than with bupivacaine. Whether the injection should be done at the start of surgery or at the end is disputed. Injection at the start will potentially contribute to preoperative analgesia, but the resultant effect on general anesthetic dose reduction has been none or negligible in most studies. With injection by the end, the effect will last longer than if the injection is done 1-2 hours previously. Some surgeons may even prefer to do both; before and at the end. The injection initially may then be with a rapid and shortacting agent such as 5-10 mg/ml lidocaine, eventually with a vaso-constructive agent (i.e. epinephrine added) in order to reduce wound bleeding.

There are also some studies in the literature advocating installation of local anesthesia in the peritoneal cavity (Kahokehr, 2011). This seems to be more effective for dedicated upper abdominal surgery, such a liver or gallbladder surgery, whereas the effect in general laparoscopy, such as bariatric, is more doubtful. Whatever local anesthesia techniques are used, the surgeon should take care to obey the rules of maximal doses for general toxicity of the drugs, and these considerations should be based on mg local anesthesia per kg ideal weight, not actual weight.

The obese patient will generally benefit from spending as short time as possible on the operating table, thus, a rapid and technical accurate surgeon is very highly appreciated in these patients.

3.2 For the anesthetist

Tthe goal will be to have proper anesthesia when needed, but a rapid emergence and resumption of adequate respiration and physiology very shortly after the end of the procedure (Bergland, 2008). Anything done to minimize the need of postoperative opioids and minimize the risk of postoperative nausea and vomiting is very valuable.

3.2.1 Issues for general anesthesia induction (see also recipe)

Usually it will be possible to find an IV access in these patients, for instance at the inside of the lower underarm there are some thin veins not covered by fat. However, occasionally there may be an indication for ultrasound guided access to a central vein if nothing else is

possible (see above). The patients should be with 20-30 degrees elevated trunk (half-sitting) during induction, preferably be a special pillow or by adjusting the operation table. This position has three functions: it will prevent regurgitation, improve lung function (compared to supine) and also facilitate mask ventilation and laryngoscopy for intubation. A potential drawback may be increased risk of hypotention after induction with this position, thus titrated dosing is advisable and a ready availability of vasopressors, such as ephedrine or fenylefrine. Also a rapid running infusion of crystalloid or colloid is useful. Rapid sequence induction is not needed in these patients if they otherwise fulfil fasting criteria. In case of rapid sequence induction there may be a case for high dose rocuronium (i.e. 0.8-1.2 mg/kg ideal weight) instead of suxamethonium, as the latter is associated with an increased risk of anaphylactoid reactions compared with the non-depolarising agents.

Proper pre-oxygenation with a tight fitting mask and PEEP of 10 cm H_2O is very useful, and shown to result in an extra 1-2 minutes before de-saturation occurs, if some airway problems arise later on. An end-tidal oxygen concentration of 80-90% on mask is a good sign of successful pre-oxygenation. Laryngeal mask airway (LMA) and spontaneous ventilation is basically beneficial for minimizing airway reactivity and optimizing lung physiology, especially in the obese. However, in the obese there is a need for high inspiratory pressure in order to overcome the resistance of the fat-coat surrounding the rib cage. With an LMA this higher pressure may result in inspiratory leakage, and frequently transition to endotracheal tube is needed. With laparoscopy and bariatric surgery even more so, because there is a considerable intrabdominal pressure adding to the resistance during inspiration. In conclusion, endotracheal intubation is recommended as routine airway management in these patients (Raeder, 2010a). Intubation may be achieved with propopfol + remifentanil only, but the high dose need and subsequent risk of hemodynamic instability makes the use of non-depolarising neuromuscular blocking agent a better choice. The intubation conditions will be more reliable and the anesthetic agents may be kept lower in dosing. After intubation, a recruitment manoeuvre is beneficial to blow up the lungs, and then maintain a PEEP of 10 cm H_2O throughout the case, with a new recruitment before extubation. Whereas pressure control ventilation mode is better for lung physiology, the volume mode is safer in terms of delivering a proper and fixed tidal-volume, which again should be adjusted to ideal weight, 6-8 ml/kg. Especially during laparoscopy the high and variable peritoneal pressure may result in very low or variable tidal volumes with the pressure control mode, unless the settings are frequently adjusted.

Recommended drugs for induction will be propofol + remifentanil (see recepe below)

3.2.2 Issues during maintenance

All the fat soluble agents are problematic to dose in the obese, because they distribute according to slightly more than ideal weight at start (i.e. corrected ideal body weight) and then more and more to total weight as the fat gets slowly loaded with drug (Servin, 2006; Raeder 2010a). An exception is remifentanil which is degraded before diffusing into the fat, and thus is very suitable for continued use in the obese. Propofol may be used for induction according to corrected ideal weight, but maintenance beyond 30-60 min calls for increase in dose, which is best titrated by using a brain function monitor, such as the BIS or similar device. Among inhalational agents, desflurane is the best in terms of less tissue binding and

more rapid emergence compared with the other potent inhalational agents. Still, sevoflurane or even isoflurane may be used in these patients, but then more care is needed to taper down the concentration during the last part of the operation in order to ensure reasonable fast emergence (Baerdemaeker, 2003). Nitrous oxide is very rapidly acting and rapidly eliminated, but the potency is low and this agent may only be used as an adjunct to either propofol or a potent inhalational agent for anesthetic maintenance.

3.2.3 Issues for ending the case and postoperative issues

With dedicated use of maintenance drugs, it should be possible to have a rapid emergence, and extubation, also in the obese bariatric cases. It is very important to be generous with anti-emetic prophylaxis in these patients as well as providing an optimal non-opioid analgesia (see below). The patients should be awake within 5 min to an extent enabling them to help in transfer from the operating table to the bed. During transport to the postoperative care unit, the patients should be laying on the side, with the head lightly elevated, 2-3 litres of oxygen per min by nose catheter. A pulse-oxymeter should be connected during the transport to recovery, as well as during the recovery stay. In the PACU, half sitting position should be rapidly encouraged and the patients should be tested for breathing room air when they are reasonable awake. A pulse-oxymeter saturation on room air of 92% or more is satisfactory. With such a value or higher the patient should not have oxygen supply. It has been shown that oxygen supply when not needed, may increase the risk of micro-atelectasis in the lung. Further monitoring in the PACU will include regular non-invasive blood-pressure measurements and continuous ECG registration. When the patient is fully awake, monitoring may be limited to pulse-oxymeter only. Slow intravenous fluid from the period of surgery may be continued until the patients drinks, typically an amount of 1-2 litres of krystalloid iv solution is sufficient for the total peri-operative period, unless there has been significant blood-loss.

Within 2-4 hours the patients should be able to mobilize on the floor, and be ready for discharge to the ward.

3.2.4 Prophylaxis and treatment of pain, nausea and vomiting

These are the most common and bothersome complications in the first period after surgery, and every measure should be taken to avoid and minimize the occurrence. The two important common principles for avoiding these complications will be to think prophylactic and multimodal. Multimodal means to address the problem with different drugs of different but additive analgesic action mechanisms and different potential and type of side-effects (Raeder, 2010a).

3.2.4.1 Postoperative pain

For pain the idea is to use as many different non-opioid additive acting analgesics as possible in order to minimize the need for opioids (Raeder, 2010a). As opioids should be used and given on top when necessary, they carry some dose-dependent side-effects which are non-beneficial in the postoperative period. These include: somnolescense, nausea, constipation, disrupted sleep pattern, and the more rare and serious respiratory depression and sleep apnea syndrome. While opioids usually are needed in small, titrated doses in

bariatric patients, the potential of non-opioid pain prophylaxis and treatment should be addressed first.

The concept of starting analgesic treatment before start of surgery in order to reduce nociceptive input to central pain mechanisms is disputed, while everyone agrees upon the use of having proper pain prophylaxis established when the patients awake from general anesthesia shortly after end of the procedure is well established.

Drugs useful in this context include (Raeder, 2010):

a. Local wound anesthesia: This should be given by the surgeon either at the start or at the end of the procedure (see above). If a particular wound is especially painful after surgery, the infiltration may be repeated (bupivacaine 2.5 mg/ml, 5-10 ml per wound) every 5-10 hrs, but this is rarely indicated.
b. Paracetamol: Although a fairly week analgesic the incidence and type of side-effects are low, as long as high total doses with potential liver toxixcity is avoided. Paracetamol may be used in virtually all patients. It is very well and completely absorbed after oral administration and may be started 1-2 hours before surgery, while the alternative may be to start with an IV infusion at the start of surgery. The initial dose should be 2 g (1-2 g if IV), while the continued dosing should be 1 g bid 4, either orally or IV as long as the patient have some pain, that is for 4-7 days usually.
c. Non-steroidal analgesic drugs (NSAIDs): These are very useful analgesic drugs which may be used in most patients unless clearly contra-indicated. All NSAIDs carry a risk of renal failure upon hypoveolemia, and gastrointestinal ulceration and bleeding. In the bariatric setting the new subtype of cox-II selective NSAIDs (i.e. coxibs: celecoxib, etoricoxib, lumiraccoxib, parecoxib) have some beneficial characteristics and should therefore be preferred. They have less risk of allergy and asthma, they have no influence on trombocyte adhesion and no risk of bleeding, and the chance of developing gastric ulceration is less than with traditional NSADs (i.e. naproxen, ibuprofen, ketprofen, diclofenac). While an overt gastric ulcer or recent story of such is an absolute contraindication to these drugs, the coxibs may be used in patients with a cured gastric ulcer. Gastric regurgitation is no definite contraindication, unless there are overt wounds in the oesophagus. The combination of proton-pump inhibitor and a coxib is usually well tolerated, also as gastric regurgitation is mostly a defect in gastro-oesophageal sphincter and not a change in gastric juice or gastric mucosa constitution. The potential negative impact from NSAIDs on gastric anastomoses healing has not been proved; on the contrary the opioid sparing effect on gastric motility from using NSAIDs may be beneficial in this context. The much disputed risk of cardiovascular complications with these drugs is usually not relevant as these are long-term use effects. Still, all these drugs may cause some initial fluid retention and slight increase in blood-pressure, which should be monitored in high risk-patients.
d. Glucocorticoids: Although a lot of potential side-effects may occur with long term treatment, the beneficial analgesic and anti-emetic effect of a single dose perioperatively lasting up to 2-3 days is very useful. As the onset of action is slow (2-3 hours) a glucocorticoid is best given at start of surgery. Dexamethasone is most popular, because it is a pure glucocorticoid with minor effect on electrolyte and mineral balance, and because duration of a single IV dose is long. It may be wise to give dexamethasone after

the patient is asleep as there is a preservative in most dexamethasone solutions which may give strong perineal itching when given rapidly in the awake. While the dose of 8 mg IV has been proven efficacious in general laparoscopy, it may be wise to increase the dose to 16 mg in the obese bariatric patient. Alternatives to IV dexamethasone may be metylprednisolone (50-125 mg) or oral prednisolone given in advance (20-50 mg) or oral dexamethasone, 15-25 mg. As these drugs cause a slight increase in blood-sugar level, care should be taken to monitor blood-sugar levels if these drugs are used in the diabetic.

e. Opioids: These may surely be needed on top of the non-opioid multimodal regimen. Any opioid may do, but care should be taken to use small and titrated dosing. For that reason opioids with rapid onset and short duration, such as alfentanil or fentanyl, are most easy to adjust. Initially the IV route is best, for instance using fentanyl, oxycodone or morphine. Then, after the PACU period the oral alternative should be preferred. The newer opioid subclass of oral opioid agonist with norepinephric effects, such as tramadol and tapentadol, has less risk of respiratory depression, but the incidence of nausea and vomiting is quite high, especially with tramadol, whereas tapentadol so far seems promising. Buprenorphine is a weaker opioid agonist, but well absorbed orally and with long duration of effect and low risk of respiratory depression. Other oral alternatives include codeine and oxycodone. Codeine is an inactive prodrug of morphine and 5-10% of the population do not have the converting enzyme and then they have no effect of the drug. Oxycodone is a potent, well absorbed opioid which may be given in rapid acting 5 mg tablets or slow-release formulations of 10-20 mg. Some studies show less sedation or somnolescense with oxycodone when compared to equipotent doses of morphine (Lenz, 2009). As this opioid also seems to work very well on visceral pain, it may be the preferred oral opioid for the bariatric patients.
f. Other analgesics: There are quite some other non-opioid drugs which have a beneficial postoperative analgesic action: ketamine, iv lidocaine, gabapentin, pre-gabalin, cannabinoids (Raeder, 2010a).

The gabapentinoids (gabapentin, pre-gabalin) are well established for postoperative pain indication, but they may result in somnolescense, dizziness and fainting initially, when dosed to high. In bariatric patients with more than usual pain, these drugs may still be an alternative; then a modest starting dose of for instance 75-150 mg pre-gabalin may be tried, and then repeated twice a day, eventually increased carefully until 300 mg.

In the immediate postoperative period a low dose infusion (i.e. 1-2 microg/kg ideal weight/min) of ketamin may also be an option in patients with strong pain.

3.2.4.2 Postoperative nausea and vomiting (PONV)

This is a troublesome complication in the postoperative, obese bariatric patient and an aggressive approach as to multimodal prophylaxis should be applied. The reason for multimodality in this context is that no single drug is more than effective in 50% of the patients, but with different acting drug combination this incidence may be up in the 80-90% range (Raeder, 2010a). The known risk factors of postoperative nausea and vomiting include: more than average tendency of travel sickness, more than average nausea after general anesthesia, opioid use, non-smoking status, female gender. Also type of surgery,

such as laparoscopy, has been associated with higher incidence of PONV, and the use of inhalational anesthetic agents as opposed to propofol which is anti-emetic (Apfel, 2004).

A first measure to reduce the incidence of PONV is to minimize opioid effects and use in the postoperative care unit. This is achieved by using optimal non-opioid analgesic prophylaxis and treatment, and by using shortacting opioid (i.e. remifentanil) with minimal residual effect after general anesthesia.

Then, secondly, a mixture of anti-emetic prophylaxis should be used in these patients.

The basis will be a 5-HT3 blocker (e.g. ondansetron 4 mg) given by end of anesthesia and glucocorticoid given by start (see above, glucocorticoid for pain) in all bariatric patients. In patients with more than average risk it may be useful to add droperidol 1.25 mg into the prophylaxis, and consider ending the anesthesia with a period of propofol infusion instead of desflurane all way through.

If the patient develops nausea in the postoperative unit, it is important to rule out and treat some non-pharmacologic reasons for PONV: dehydration, hypotention, hypoxia or sudden movement. If anti-emetic drug treatment is needed it is wise to supplement with a drug the patient not already has received; that may be either metoclopramid (10 mg iv, eventually repeated) or ephedrine 5-10 mg IV. Ephedrine is especially efficient in those patients who experience nausea when moving or mobilizing, and if this is a consistent problem a sc injection of 25-40 mg ephedrine may be of help.

In more resistant cases the new class of NK-1 antogonisk anti-emetics may be tried.

4. Anesthetic recepe

There are many successfyl ways to run general anesthesia in bariatric surgical patients, but this is a well tested recepe, now being applied to more than 2000 consecutive patients in a dedicated clinic for these procedures (Bergland, 2008). These patients should have standard monitoring with ECG, noninvasive blood pressure measurement, pulse oximetry, nerve stimulation test of neuromuscular block (i.e., TOF guard®), end-tidal CO_2 measurement, and anesthetic gas analysis. An arterial line for invasive blood pressure measurement is only inserted if specifically indicated, e.g., patients with known cardiovascular problems.

It may be useful to monitor the depth of anesthesia in these patients, but this may be skipped during inhalational-based anesthesia if end-tidal MAC values are above 1 MAC all the time.

Our recipe for obese patients undergoing laparoscopy is as follows:

An iv infusion of 500 ml starch, colloid solution is running rapidly, followed by a slow infusion of crystalloid (0.5-1.0 liter during the procedure).

When preoxygenation is fulfilled, anesthesia is induced with fentanyl 100 micog, propofol and remifentanil plasma target controlled infusions (TCI) with targets of 6 microg/ml and 8 ng/ml, respectively. Both infusions are based on corrected ideal weight (height in centimeters minus 100, plus 20% of the difference between the real weight and ideal

weight), propofol with the Marsh effect site model and remifentanil with the Minto effect site model.

Then, vecuronium 0.08 mg/kg corrected ideal weight is given.

Tracheal intubation is performed with the patient in the semi-sitting position with their torso flexed and the head extended in the neck ("sniffing the morning air" position). A standard laryngoscope with a short handle and an endotracheal tube with a stylet are used.

After the tracheal tube is secured, the propofol infusion is stopped and inhalation of desflurane at 3–6 % (i.e., 0.5 – 1 MAC) is started. Inspiratory oxygen is reduced to 40% and PEEP to 5 cmH_2O.

A gastric tube is inserted and the gastric content (if any) is aspirated.

Anesthesia is continued throughout the operation with remifentanil and desflurane. The doses are adjusted according to clinical observation, arterial blood pressure, and bispectral index (BIS). Typically, remifentanil TCI is adjusted within a wide range to keep systolic blood pressure within acceptable limits (i.e., 85–120 mmHg) and desflurane is adjusted to keep the BIS within the range of 45–55. If no BIS is available an endtidal concentration of 0.7-1.0 MAC desflurane should be used.

Droperidol 1.25 mg, ondansetron 4 mg, and dexamethasone 16 mg are given as routine iv antiemetic prophylaxis.

Parecoxib 40 mg and paracetamol 1g are given iv, and bupivacaine 2.5 mg/ml is infiltrated around the incisions, in a total volume of 30–40 ml, to prevent postoperative pain. Furthermore, fentanyl 100 microg is given before the end of surgery.

Desflurane and remifentanil are stopped upon removal of the laparoscope at the end of surgery, and a small dose of propofol (30–50 mg total) is then given. The neuromuscular block is reversed with neostigmine 2.5 mg and glycopyrrolate 1 mg and the patients are ventilated with 100% oxygen. The patients are extubated on the table when they are emerging, breathing, and showing the first signs of irritation from the tracheal tube. Then patients move themselves, with some assistance, into the bed.

Analgesia (present at emergence):

- bupivacaine/ropivacaine wound infiltration
- paracetamol 1.0 g iv
- parecoxib 40 mg iv (or ketorolac 30 mg iv)
- dexamethasone 16 mg iv
- fentanyl 1–2 microg/kg at the end of surgery

Anti-emesis:

- droperidol 1.25 mg iv
- (dexamethasone, also given for pain)
- ondansetron 4 mg iv
- propofol anesthesia + remifentanil anesthesia, no nitrous oxide, low opioid hangover

5. References

Apfel CC, Korttila K, Abdalla M, et al. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. N Engl J Med 2004;350:2441-51.

Bergland A, Gislason H, Raeder J. Fast-track surgery for bariatric laparoscopic gastric bypass with focus on anaesthesia and peri-operative care. Experience with 500 cases. Acta Anaesthesiol Scand 2008;52:1394-9.

Buchwald H, Oien DM. Metabolic/bariatric surgery Worldwide 2008. Obes Surg 2009;19:1605-11.

Chung F, Mezei G, Tong D. Pre-existing medical conditions as predictors of adverse events in day-case surgery. Br J Anaesth 1999;83:262-70.

Chung SA, Yuan H, Chung F. A systemic review of obstructive sleep apnea and its implications for anesthesiologists. Anesth Analg 2008;107:1543-63.

Chung SA, Yuan H, Chung F. A systemic review of obstructive sleep apnea and its implications for anesthesiologists. Anesth Analg 2008;107:1543-63.

De Baerdemaeker LE, Struys MM, Jacobs S, et al. Optimization of desflurane administration in morbidly obese patients: a comparison with sevoflurane using an 'inhalation bolus' technique. Br J Anaesth 2003;91:638-50.

De Baerdemaeker LE, Struys MM, Jacobs S, et al. Optimization of desflurane administration in morbidly obese patients: a comparison with sevoflurane using an 'inhalation bolus' technique. Br J Anaesth 2003;91:638-50.

Dindo D, Muller MK, Weber M, Clavien PA. Obesity in general elective surgery. Lancet 2003;361:2032-5.

Kahokehr A, Sammour T, Srinivasa S, Hill AG. Systematic review and meta-analysis of intraperitoneal local anaesthetic for pain reduction after laparoscopic gastric procedures. Br J Surg 2011;98:29-36.

Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. Ann Surg 2008;248:189-98.

Kira S, Koga H, Yamamoto S, et al. Anesthetic management of laparoscopic adjustable gastric banding in Japanese patients with morbid obesity. J Anesth 2007;21:424-8.

Leifsson BG, Gislason HG. Laparoscopic Roux-en-Y gastric bypass with 2-metre long biliopancreatic limb for morbid obesity: technique and experience with the first 150 patients. Obes Surg 2005;15:35-42.

Lenz H, Sandvik L, Qvigstad E, et al. A comparison of intravenous oxycodone and intravenous morphine in patient-controlled postoperative analgesia after laparoscopic hysterectomy. Anesth Analg 2009;109:1279-83.

Lofsky A. A Lofsky, Anesthesia Pt Safety Foundation Newsletter 2002; 17:24-5. Anesthesia Pt Safety Foundation Newsletter 2002;17:24-5.

Nishyiama, T, Kohno, Y, and Koishi, K. Anesthesia for Bariatric Surgery. Obes Surg . 2011. 2011. Ref Type: Online Source

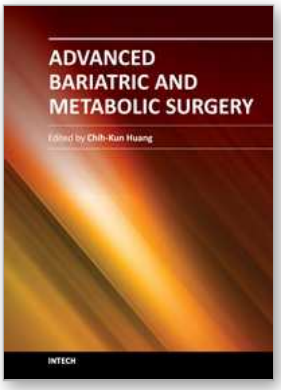
Raeder J. Clinical ambulatory anaesthesia. Cambridge University Press, 2011.

Raeder J. Bariatric procedures as day/short stay surgery: is it possible and reasonable? Curr Opin Anaesthesiol 2007;20:508-12.

Servin F. Ambulatory anesthesia for the obese patient. Curr Opin Anaesthesiol 2006;19:597-9.

Soreide E, Eriksson LI, Hirlekar G, et al. Pre-operative fasting guidelines: an update. Acta Anaesthesiol Scand 2005;49:1041-7.

Young T, Palta M, Dempsey J, et al. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 1993;328:1230-5.



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Bariatric surgery has gained importance in the last 20 years because of the high prevalence of global obesity, and the vast understating of the physiological and pathological aspects of obesity and associated metabolic syndromes. This book has been written by a number of highly outstanding authors and pioneering bariatric surgeons from all over the world. The intended audience for this book includes all medical professionals involved in caring for bariatric patients. The chapters cover the choice of operation, preoperative preparation including psychological aspect, postoperative care and management of complication. It also extends to concept and result of metabolic surgery and scarless bariatric surgery.

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