

The first
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edition

Critical Care News

Obese and morbidly-obese patients – addressing the challenges of perioperative ventilation

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Dr Robert H. Pinsker in his office at El Camino Hospital, Palo Alto

Obese and morbidly-obese patients – addressing the challenges of perioperative ventilation

Since the last issue in which a Spanish anesthesiologist was interviewed, Critical Care News has been focusing on certain high-risk patient groups and decided to meet with three clinicians specialized in anesthesia for the obese and morbidly obese patient, to hear what they had to say about the challenges they face in terms of peri-operative ventilation for this patient group.

Critical Care News first met with Dr Jan Paul J. Mulier, MD, PhD during a congress in Austria. Dr Mulier is Founder of the ESPCOP (European Society for peri-operative care of the obese patient) and works at Sint Jan Hospital in Brugge, Belgium.

It was also interesting to travel to the United States and to meet with two anesthesiologists specialized in Bariatrics to hear what they had to say. Dr Jeremy Collins, Chief Assistant Professor of Anesthesia at Stanford University Hospital and Dr Robert H. Pinsker, Medical Director of Anesthesiology at El Camino Hospital, both in Silicon Valley's Palo Alto in California, related their experiences in this field.

Dr Robert H Pinsker, MD, JD

Are you seeing more obese patients presenting for surgery? How does this affect their care as a patient group?

Dr Robert H Pinsker: At our hospital, we are definitely seeing an increased number of morbidly-obese patients, partly because we are an accredited bariatric centre of excellence. Bariatric patients are thus directed here for quality as well as insurance reasons. However, the generic literature, but not necessarily the medical, suggests that obesity may not be growing among adults, and yet we seem to be seeing an increased number of obese patients in our practice; it definitely appears to be on the increase in children. These patterns entail difficult airway management and ventilatory issues. An extensive number of spinal patients, for example, are often obese and as many as half will require surgery in the prone position, which can lead to very complex ventilation issues. But it's not just this area that is problematic. Obese patients can be found scattered throughout all specialities, not only in bariatric surgery.

How different are these patients and how do these differences affect the anesthetic process?

Obese and morbidly-obese patients can be anatomically and physiologically challenging. Studies suggest they have a closing capacity that is significantly different, for example. They also have atelectasis when awake and standing, which, of course, is aggravated by the anesthetic process.

With general anesthesia, the first major concern is securing the airway either before or after the patient is induced. When an obese patient is under MAC (Monitored Anesthetic Care), i.e. sedation, their higher incidence of Obstructive Sleep Apnea (OSA) presents an issue of less airway control, despite the fact that one is avoiding

general anesthesia. Nevertheless, it's general anesthesia that gives the most cause for concern; absent awake intubation, one must make certain that there can be successful induction followed by successful mask ventilation and, ultimately, intubation.

What are your challenges with intubating these obese patients?

When one suspects a patient might be difficult to intubate once induced, one must also ask whether that patient might also be difficult to mask ventilate. Avoiding the so-called "cannot mask, cannot intubate" situation is critical, but, fortunately, these are fairly small in number.

What considerations would you normally implement to optimize ventilation during the maintenance phase?

The anatomical and physiological profile of an obese patient means that one wants to try to maintain the patient in a modified upright position. Unfortunately, this is not possible in most of the cases we see today, including bariatric surgery. In fact, one is expected to be able to place the patient in a fairly steep Trendelenburg, or head down, position. What's more, many procedures are done laparoscopically, during which the increased intra-abdominal pressure compromises the functional residual capacity of the lungs. However, one can usually accommodate for this. In most patients without additional underlying lung disease, positive pressure ventilation, usually including end expiratory pressure, often solves the problem.

Can you give a specific example that illustrates the ventilatory challenges you face for these patients?

As a cardiothoracic anesthesia specialist, I can say that an obese

patient necessitating a pulmonary lobectomy would pose special challenges because we have to be able to provide one-lung ventilation.

One would typically start by obtaining baseline pulmonary function testing. However, this is not always reliable because it doesn't fully anticipate ventilation perfusion mis-match once a lung is collapsed. In addition, once an obese patient is in the lateral position, even before a lung is collapsed, his or her physiology can change dramatically, and this can lead to having, at times, to abort the procedure. Obviously, that is something nobody prefers to see occur. These are all challenges that we need to handle and we have a number of options available. We can apply different degrees of pressure to one or both of the lower and the upper lungs, for example, although with the collapse of the operative lung, we generally prefer not to see peak pressures higher than 10 cm of water. Some, however, can tolerate more than that.

Adjusting the gas flow rates or altering the inspiratory ratios are additional alternatives. Note, however, that applying end expiratory pressure often makes things worse, not better. We've also tried different maneuvers with bronchial blockers (instead of a so-called double-lumen tube), including application of pressure via the blocker. Each patient can present very much a "work in progress," so to speak. Each patient responds differently, so there's no standard formula that works every time. That's a challenge in itself.

Many obese patients suffer from atelectasis even when upright and awake. Do you systematically perform recruitment maneuvers in these patients using a standardized protocol?

That's an interesting question. The whole concept of employing recruitment maneuvers is fairly new to



El Camino Hospital, "The Hospital of Silicon Valley"

anesthesiologists, at least in the United States. But I feel that many of us have been doing these maneuvers for years without really knowing what to call them and assigning them a specific name.

Please tell us about your recruitment protocols. What difficulties, if any, do you experience?

In the case of a patient who is not undergoing pulmonary surgery, there is "no surgeon in the chest", so to speak, and one has the option of intermittently taking the patient off the ventilator in order to manually attempt one or more recruitment maneuvers. One such method involves maintaining high pressure for 5 to 10 seconds, while keeping a close eye on the hemodynamics, which in obese patients can be negatively impacted very rapidly.

Where thoracic surgery is underway, one must communicate with the surgeon at all times in order to make certain that whatever maneuver is attempted, it does not impact the surgery negatively. In a severely ill patient experiencing difficulties with oxygenation or otherwise poorly tolerating one-lung ventilation, one may need to request that the surgeon stop at least momentarily in order to permit reinflation of a collapsed lung.

What can lead to post-operative ventilatory complications in the recovery room and how can the risks be diminished?

Total airway obstruction is the main risk. One wants to avoid transporting morbidly obese patients to the recovery room who are still moderately sedated and/or asleep. It is occasionally

necessary nevertheless, however, and extubating anesthetized patients is what we call deep extubation. In these cases, it is particularly important that the patients be assisted with oral airway devices that stent or maintain open their upper airways.

Additional, more specific problems encountered with obese, neurosurgical patients include high intra-cranial pressures, so one may not want increases in blood pressures of these patients. Nor does one want such a patient to be coughing or bucking on the intra-tracheal tube as they emerge from anesthesia.

While one can't guarantee a smooth emergence from anesthesia in obese patients, one way to help affect it is with opiate administration. Titrating in doses of a short-acting opiate can get



The Golden Gate in San Francisco, CA

the patient to the point where all the other anesthetics can be discontinued, including the gas anesthetics. If there's no other medication on board, one can actually wake most patients up with the endotracheal tube in place and absent coughing or bucking.

The problem is that, because opiates remain in a patient's system, obese patients who have received these drugs and transferred to the ICU or ward can become re-sedated, or what we label re-narcotized. Moreover, a lot of these patients are not prone to voluntarily breathing deeply. In other words, sedation makes it difficult to "recruit" or re-open collapsed alveoli. Therefore, increased atelectasis in addition to an already low functional residual capacity can become disastrous.

One must encourage patients to perform their own recruitment maneuvers, in other words, to work every hour or so against a certain positive pressure. There's nothing fancy about this technique; patients can do it on their own, without a machine – one such maneuver involves simply taking a big breath and holding it.

What mode of ventilation do you find most effective for obese patients?

The Pressure Support mode. We use this for non-intubated patients who have an LMA in place, but also for the intubated and obese who are undergoing short procedures. We're able to keep them spontaneously breathing so they'll be easier to wake up without having to administer muscle relaxation. Without Pressure Support, you often can't maintain proper oxygenation.

We're convinced that Pressure Support needs to be almost universally used in such cases. We have it at the hospital and would also like it at our out-patients surgery center, to where most of these patients come.

What do you view as the limitations of existing studies addressing perioperative ventilator challenges for the obese and morbidly-obese? Are enough patients being included?

Here I have to give you a somewhat empirical answer. I focus on reading anesthesia literature, which, in the U.S.,

largely consists of two main journals. We also reference current textbooks and exchange the occasional letter on the subject, but we don't read a great deal of international literature. I'm not an expert on judging the validity of studies either.

Having said this, I don't think there's a scarceness of literature addressing perioperative ventilatory issues in obese patients. On the contrary, I think everybody in the States acknowledges that these are important issues, particularly regarding the need to address the relevant problem of OSA. ■

Biography

Dr Robert H Pinsker, MD, JD, Robert Pinsker, MD, JD is a double board certified physician as well as attorney who currently specializes in anesthesiology and anesthesiology program management.

In addition to being trained in and having practiced for many years the sub-specialty of cardiothoracic anesthesiology and critical care medicine, from 1995 to early 2004 Dr Pinsker practiced intellectual property law with the Palo Alto-San Francisco law firm of Flehr, Hohbach, Test, Albritton & Herbert, LLP. In this capacity, he secured intellectual property portfolios for a number of medical device start up companies and served on numerous Scientific Advisory Boards.

Subsequently, Dr Pinsker became a consultant in medico-legal administrative and medical program management. Presently, Dr Pinsker serves as the Medical Director of Anesthesiology at El Camino Hospital and Kindred Hospital, S.F. Bay Area, in Hayward, as well as the Medical Director of the El Camino Surgery Center.

Dr Pinsker is the founder of multiple companies, including Fidere Anesthesia Consultants, Inc., Pacific Physicians Medical, Inc., Doctors Billing Service, Inc. and Fidere Capital Investments, LLP.

Dr Collins, Stanford University Hospital



Dr Jeremy Collins in his office at Stanford University Hospital, Department of Anesthesiology

Please give us your views on obesity demographics. What changes have you seen over the last 15 years?

Dr Collins: I have worked in Europe and the US and I can say that the situation is the same in both. The idea that obese and morbidly obese patients are only found in America is just not true.

However, I believe that the US is more likely to see the emergence of a small, super morbidly-obese population. We are now also seeing more numerous younger patients presenting with obesity, as well as more adolescents needing bariatric surgery. Interestingly, the concerns that bariatric surgery in the young leads to malabsorption issues that affect their subsequent development appear to not be the case. The fact that this intervention may help prevent diabetes and irreversible cardiac defects in patients at risk means that it is now

viewed as being worthwhile. In terms of a national health issue, the long-term health savings can be significant. Another interesting fact is the preponderance of female patients presenting early, perhaps due to aesthetic reasons. Males tend to present at an older age with problems related to the co-morbidities associated with their obesity.

What about the different measurement tools used in diagnosing obesity? Which one, other than BMI, is used and do they help the practitioner in assessing the patient's ventilatory parameters?

I think that a lot of the co-morbidity associated with obesity is related to truncal obesity. As hip/waist ratio is a better reflection of truncal obesity, I think we will find that it offers a closer correlation to poor ventilation and sleep apnoea than BMI, for example.

I've seen some correlations where ventilatory parameters improved as patient hip/ratios went down.

We also know that women have a higher BMI partly due to the fact that they've got larger lower bodies. For an anesthesiologist, weight centered around the lower half of the body is not really a major concern.

Do you find that the obese patient in anesthesia is a good model for other high-risk groups?

Yes, that's certainly the case. Firstly, the know-how with the obese helps in dealing with "normal" patients as well. If you are confident in managing obese or morbidly-obese patients with exaggerated pathophysiologies, you will find it much easier to deal with lean patients.

Secondly, when you encounter a high-risk patient in another speciality, you won't have to re-think everything in terms of managing their airway, the equipment, the ventilator, the operating table, etc. You will be used to a more complex situation and the high performance equipment that will help you handle it.

But it seems like even those of us who are not dealing with obese patients on a regular basis will soon have to do so. I believe that a study made in Pennsylvania in 2007 suggested that 1 in 12 patients had a BMI of over 40. And in a cohort of 20,000 patients, something like 365 had a BMI of over 50, that is one per day in the operating room having non-bariatric surgery.

What measures would you consider implementing to optimize ventilation, bearing in mind the anatomical and physiological profile of obese patients?

Their reduced functional residual capacity means that their tendency to desaturate is much greater than in the "normal" patient. Mass loading of the chest and abdomen can be partially offset by positioning in a more upright manner. Early control of ventilation with adequate paralysis prevents the poor tidal ventilation and subsequent desaturation that occurs with bucking on the endotracheal tube. This can be associated with extremely high airway pressures and is not well tolerated by these patients.

In the super morbidly-obese patient (BMI 50-70), many of these problems are exacerbated. Moreover, most bariatric cases are done laparoscopically and the increased intra-abdominal pressure compounds those difficulties that I just mentioned.

However, we sometimes have a mechanical advantage in the fact that a lot of the surgery is done in the reverse Trendelenburg position. This off-loads some of that muscle and fat from the abdominal wall and makes ventilation a little easier. But in many gynecological procedures, the opposite applies because of the need to place the patient head down. If you have a morbidly-obese patient having surgery

in the Trendelenburg position, it may be impossible to ventilate them effectively. We may have to tell the surgeon "The patient won't tolerate this degree of tilt. We maybe have to think about doing an open procedure." This is far from ideal, however, as it is going to mean that the patient's post-operative course is going to be that much more difficult.

What cases do you consider to be most challenging when caring for the obese?

The non-elective, trauma situation. From an anesthesia point of view, this is a big contrast to bariatric surgical procedures, where we have the situation under quite good control. An obese to morbidly-obese person involved in a car accident is definitely more challenging in terms of airway management, respiratory function and vascular access. With a trauma patient having suffered fractured ribs and perforation of the lungs, leading to pneumo and hemothorax, for example, their airway pressure is likely to be significantly higher than in the elective situation. It may then be that you have to generate quite high pressures in order to expand the lungs effectively and maintain them open.

What challenges arise when patients are put to sleep and given muscle relaxation?

Lean patients get some degree of atelectasis, particularly when you give them 100% oxygen, but this is often even more dramatic in the morbidly obese, where up to 20% atelectasis is more common. Although the 100% oxygen used to pre-oxygenate will contribute to atelectasis, the priority in morbidly-obese patients is to maximize the efficacy of pre-oxygenation - this will lengthen the period of time following anesthetic induction before hypoxia develops. The literature suggests two simple approaches.

One is to use some degree of head elevation, for example reverse Trendelenburg or beach chair position. The other is to use CPAP in the pre-oxygenation phase. Pre-oxygenation with 100% oxygen in the head-up position

combined with a period of CPAP has been proposed as a means of prolonging the time to desaturation even more.

What ventilating mode would you use in order to minimize eventual post-operative ventilatory complications?

In the future, it might be worthwhile investigating whether we could minimize atelectasis by using 80% oxygen and maximize the time to desaturation by using CPAP. Obese patients also have around 10-fold more likelihood of OSA, so many of them are prescribed CPAP anyway. However, compliance rates are only about 50%, because patients often consider CPAP uncomfortable, noisy or claustrophobic. Nevertheless, I think we would see a benefit in terms of reduced atelectasis with just 5 or 10 minutes of preoperative CPAP in the upright position, either in the preoperative area or in the OR before we put them to sleep.

I believe that we are seeing increased awareness that CPAP is also safe to use in the immediate postoperative period, and that can be as soon as the tube comes out.

However, the logistics of giving CPAP in the post-operative unit are difficult. In the future, what we may see is a cohort of the severely obese population – BMIs of 70 and above – having some kind of nasal non-invasive ventilation, both in the preoperative and the postoperative areas.

Naturally, we don't want to put patients at increased risk of aspiration by giving so much gas into the upper airway and the esophagus that they then get gastric dilation and aspiration. But if we do it in a controlled way with comfortable nasal strapping or an oro-nasal mask, and we can see the pressures on the ventilator, we could avoid this worry.

How important is ventilator performance in overcoming the special physiological challenges you meet?

Ventilator performance is important -being able to generate higher peak pressures to control poor lung compliance or high intra-abdominal pressures is a good example of specific



Dr Collins in the departments staff room

requirements that are necessary with this patient population.

I try to set the tidal volume to a multiple of ideal body weight based on height rather than actual body weight as the latter may produce tidal volumes that are too big and cause more barotrauma. Even then it may be necessary to accept higher ventilatory pressures to achieve these volumes. I think that it is safe to go to higher pressures as long as the tidal volume is not too great. Experience from the ICU that large changes in volumes cause more morbidity than higher pressures alone.

Assuming that the patient was cardiovascularly stable, I would also attempt to increase oxygenation by using PEEP. This may also assist in minimizing post operative atelectasis. This may result in having to accept higher ventilatory pressures—for example going up to 50 centimeters of water is not uncommon. In a morbidly-obese population, you sometimes have to go

this high to make sure oxygenation is adequate. Pressure Control rather than Volume Control may result in greater tidal ventilation for a given pressure. I've found with a lot of standard ventilators that I've used, when high inspiratory pressures are needed quickly, they are just not powerful enough. In the past, I would sometimes request that an ICU ventilator be brought to the OR so that I could use a more powerful pressure generator. Hopefully, that's not going to be necessary in the future.

What about the situation today? In which cases do you bring an ICU ventilator in to the O.R.?

I do not do that routinely, largely because we don't have that many extremely obese patients. However, if this situation changes, it would be certainly worth considering, especially when the patients have more complex co-morbidities such as pulmonary hypertension, COPD and pulmonary edema.

With a very obese patient, weighing 900 pounds, for example, who is on high ventilation settings and a lot of PEEP, it is highly desirable that the quality of ventilation is not interrupted during transport between the OR and ICU. Having an inferior ventilator in the OR can lead to sudden hypoxia, a reduction in tidal volumes and an increase in atelectasis.

Could you tell us something about the recruitment maneuvers you recommend. What is your current clinical practice in this field?

PEEP of around 10 is one aspect of my current practice. But if you have good respiratory monitoring from your ventilator in the OR, you may be able to find a more optimal PEEP setting. I recall a study looking at recruitment maneuvers that I believe showed going up incrementally from 10 PEEP to 15 then to 20. This improved PO_2 and compliance as well.

Regular recruitment maneuvers using PEEP thus seem important if you want to minimize atelectasis.

In addition, there may be a subset of patients, e.g. those with very heavy chest walls, that might need PEEP pressures very much higher than the levels regarded as “conventional” by many physicians. Levels perhaps even higher than the 50 centimeters of water that I mentioned earlier may be required to expand the lungs effectively and keep them open.

I also feel that the benefits of such recruitment maneuvers may sometimes be lost at the end of surgery. We should be better at maintaining a certain degree of recruitment post-operatively in the first 24 hours, the period when these patients are at high risk of episodic desaturation. Receiving more direct input from critical care staff or respiratory therapists would be beneficial in terms of addressing such post-operative issues.

What ventilator modes do you find to be useful in other phases of the procedure?

I find Pressure Support most useful towards the end of the surgery, as I’m trying to get the patient to return to spontaneous respiration, rather like an extubation maneuver. In the morbidly-obese patient, who may be a difficult intubation and have OSA, it is important to make sure that they are adequately awake before you extubate to avoid early airway obstruction and avoid a need to use positive pressure mask ventilation, which may put the new anastomosis under strain.

How important is patient positioning in helping to optimize peri-operative ventilation?

I spend up to 10 minutes making sure the patient is in a very good position for intubation. But we then take away

that positional support after intubation and therefore face problems lifting them back into that same position later because they are so heavy. As we cannot achieve the same ideal position for extubation that we can for intubation, the conditions are non-ideal at the end of the case. We thus need to be absolutely sure that the patient is adequately awake before we extubate. That relies on good anesthesia so that patients can tolerate the endotracheal tube without coughing and bucking and pulling it out. Whatever ventilation mode you are using, it is important that patients can breathe comfortably on the ventilator to guarantee their airway, and so that they won’t panic.

If we come back to the issue of ventilatory modes for these patients, is there anything you would like to add regarding the end of the procedure?

A good ventilator and good ventilation modes are important. There’s nothing worse than losing good intra-operative tidal volumes with good PEEP at the end because the patient is fighting the ventilator or because you are trying to return to spontaneous ventilation in the supine position, which is not a good position for obese patients. A good spontaneous mode of ventilation that is assisted is very useful at the end of the act when you want to maximize tidal volumes and minimize the occurrence of sudden atelectasis. ■



Main entrance of Stanford University Hospital, Palo Alto

Biography

Dr Jeremy Collins, MD, Chief Assistant Professor of Anesthesia, is originally from the United Kingdom, but has been established in California for the past ten years. He is affiliated to both Stanford University Hospital and Lucile S. Packard Children’s Hospital, both in Palo Alto, CA. He works closely with Dr Jay Brodsky, Professor of Anesthesiology at Stanford University Hospital, and is the author of numerous publications in the field of airway and anesthesia management of the obese patient.

Dr Jan Mulier, MD, PhD

Which special ventilation aspects do you consider with respect to anesthesia of the obese patient?

When ventilating obese patients, you should not only look at the thoracic compliance but also at the abdominal compliance. By solving the abdominal problems, you also solve the ventilation problems. That is the approach I have been applying in the last two years instead of adapting the ventilator settings only. Traditionally, the laparoscopic surgeon does not care about ventilation, and we, anesthesiologists do not care about surgical workspace. Therefore the abdominal compliance issues were believed to be the realm of the surgeon only. In my view the diaphragm should no longer divide the body between abdominal surgeons and anesthesiologists. My aim today is to see if I can change the abdominal compliance to improve the surgical workspace and the ventilation at the same time. Helping the surgeon with his problems is the reason for our existence as anesthesiologists in the past. We developed our own activities and responsibilities to the patient and forgot the surgical problems. We as anesthesiologists have to improve not only the anesthetic outcome that is already very good but also the surgical outcome by using our knowledge as an applied physiologist. This new way of thinking I call the trans-disciplinary approach that goes one step further than team work.

What methods do you apply when ventilating an obese patient who might be difficult to ventilate?

When I have an obese patient who is difficult to ventilate with high airway pressures, I have several strategies that I can apply: The first one is to give them continuous sufficient muscle relaxant allowing the abdomen to relax maximally and

lower the intra abdominal pressure (IAP) which improves ventilation. Another aspect is positioning of the patient in the beach chair position. By flexing the legs and giving anti-Trendelenburg inclination, we improve the abdominal compliance and lower the IAP. This creates more space for the lungs and lowers the airway pressures again. Beach chair position also prevents also venous stasis. A patient with a BMI of 60 or more has to lose 20 kg or more before the operation to make it easier to insufflate the abdomen and to ventilate the lungs. Inflating the pneumoperitoneum to a minimum surgical workspace instead of a fixed certain pressure means frequently a lower intra abdominal pressure and hence an easier ventilation. In a last aspect we accept higher end-tidal CO₂ as this stimulates the cardiac output and the wound perfusion and requires a lower ventilatory minute volume.

What does high ventilation performance in anesthesia mean for you?

We can start by looking at the different ventilation modes that come to us from the ICU. For example, Pressure Support was developed to facilitate weaning and to improve synchrony between the patient's breathing and the ventilator. In anesthesia, we didn't have this problem of synchrony, for a long time we therefore didn't look at these modes. But some of these modes can also improve ventilation, even under muscle relaxation by adapting them to anesthesia. New modes can be further developed like Volume Support or Proportionally Assisted Ventilation. We can look at the speed of changes in gas concentration, needed at induction or at the end of the procedure, something most anesthesiologists are concerned with and where improvements are still possible. Opposite to speed we can look at the efficiency of gases, inhalation vapors and absorbers used all aspects the

hospital is more concerned with. We can look at the measurement capacities beyond pressures and volumes. Lung compliance for example is not linear which makes it difficult to use. Many other parameters can be measured but without clinical meaning they risk being more fancy than useful. Safety aspects in ventilators still need further improvements. Pressure controlled ventilation is dangerous for volutrauma when no volume adaptation exists and the abdomen is suddenly deflated. Pressure support can also be dangerous for volutrauma when the patient regains his strength. Volutrauma is also possible with most anesthesia ventilators when by human error one forgets to switch from manual to controlled mode with a closed APL valve or when the exhalation tubing is blocked. The safety frog we developed as an external device or built inside the ventilator can prevent this.

Why do you think there are some who say that there is no correlation between obesity and peri-operative ventilatory complications, whereas other studies show the contrary?

One reason is that not enough studies have been done on the obese and the morbidly obese patients with respect to this point. The other reason is the fact that BMI itself is not a good predictor for the risk of metabolic syndrome with its associated cardiac and pulmonary complications. The waist to hip (W/H) ratio predicts the existence of this syndrome and the complications of obesity as it better describes the fat distribution. A W/H ratio above 1,5 means that all fat is situated in the abdomen, increasing the intra abdominal pressure and making ventilation very difficult. This android (W/H > 1) fat distribution is more frequent in men than in women who tend to have more frequently a gynoid (W/H < 1) fat distribution.

It is also a fact that keeping the surgical procedure short for the obese patient

has a positive impact on outcome. The longer the procedure where you keep them intubated and mechanically ventilated, the worse the outcome is.

What about the situation of atelectasis in these patients and how do you ventilate these patients during a routine operation?

Obese patients have atelectasis even while awake and standing. They are not able to breathe deeply as the diaphragm is permanently elevated. Lying flat is very bad and anesthesia induction should start again in the beach chair position. CPAP should be available at pre-induction and during induction, followed by ventilation with PEEP. The same is true at the end of the procedure. Most anesthesia ventilators do not allow giving CPAP by mask, something that needs to be incorporated. Techniques do exist for raising tidal volume and performing recruitment maneuvers. However these require manual intervention with interruption of the PEEP level and this can be very bad in preventing atelectasis. The effect is a nice oxygen saturation. However, we are not sure that recruitment does not overstretch and damage the lungs at the same time, and thus compromising the outcome. After induction, a volume controlled or a pressure controlled mode can be used always with a low PEEP. I prefer Volume Control for its safety and will use Pressure Control if airway pressures are very high. At the end of the surgery I always switch to Pressure Support with PEEP even with full muscle relaxation. Besides a better oxygenation and a more physiological breathing, it allows us to titrate the Sufentanil dose to a maximum without impairing the respiratory rate and allowing a patient to wake up pain free.

Is the obese patient population a good model for other high-risk patients presenting for anesthesia?

Yes, of course. Understanding the physiology of the obese to extreme obese patient helps improve care of other high risk patients with comparable organ problems. The patient with acute

abdominal compartment syndrome, the patient with low cardiac output, the patient with right ventricular failure, the patient with low oxygen saturation are just some examples of high risk patients with comparable problems.

Aspects we have learned from morbidly obese patients and that we now use in other cases are the way we ventilate patients with low oxygen saturation or with high airway pressures, the way we improve skin perfusion and diminish wound infections; the way we prevent post operative surgical bleeding by increasing blood pressure and cardiac output are just some examples.

What about the different phases of the anesthesia? Do you encounter any difficulties?

One must differentiate between difficult intubation and difficult mask ventilation. By elevating the head and the thorax of the patient during induction the intubation is not more difficult than in the non-obese patient. On the other hand, mask ventilation will remain difficult even with the beach chair position, the mayo cannula and two hands available to hold the mask. Obese patients are also at higher risk for aspiration, making mask ventilation frequently dangerous, and therefore not performed.

During induction, ideal body weight is used to calculate the agent dose, while during maintenance a higher agent dose than ideal body weight is needed. You can try to calculate drug doses for every patient but will need to adapt them according to the measured effect.

Good muscle relaxation is important in patients with small abdominal compliance; this is most frequent in the android male type or young girls who have not yet been pregnant or who never have had a laparotomy or laparoscopy. Full muscle reversal is very important so that he/she can gain maximum muscle power while being fully awake. This is crucial to have them breathe deeply. Pain control is also very important and should start before the end of the operation. Loco-regional anesthesia is ideal but more difficult to perform in the obese. ■



Dr Jan Mulier at a patient's bedside at St Jan's Hospital, Brugge, Belgium

Biography

Dr Jan Mulier, MD, PhD, anesthesiologist, is founder of the ESPCOP (European Society for peri-operative care of the obese patient) and Chairman of the Department of Anesthesia at Sint Jan hospital in Brugge, Belgium. He is the author of numerous publications concerning aspects of peri-operative ventilation and has done extensive research in this field.