

An Airway and Anesthetic Protocol for Morbidly Obese Patients Undergoing Bariatric Surgery

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Abstract

Morbidly obese (MO) patients have a high risk for difficult intubation, inadequate bag mask ventilation (BMV), and/or desaturation events. Our goal was to establish a protocol for airway and anesthetic management of MO patients to minimize complications. An IRB-approved prospective study was performed at Wake Forest Baptist Health. We recruited 406 MO patients who were scheduled for bariatric surgery. The protocol had three parts: 1) premedication, preoxygenation, and positioning; 2) rapid sequence induction-intubation using videolaryngoscopy (VL); and 3) repositioning for emergence-extubation. The primary outcome measure was the use of VL that resulted in intubation in ≤ 2 minutes (min), avoided the need for BMV, and did not result in SpO₂ <90%. All 406 patients were intubated using VL. Of those, 391 (96.3%) took ≤ 2 min. BMV was avoided in 399/406 (98.3%) patients. There were 376 (92.6%) and 383 (94.3%) patients who experienced SpO₂ $\geq 90\%$ during induction-intubation and emergence-extubation, respectively. The mean time for visualization of vocal cords and intubation, (T(vi)), was 35.7 ± 23.6 seconds (s) for patients who maintained SpO₂ $\geq 90\%$. For patients who desaturated, the mean T(vi) was 66.2 ± 31.9 s. Five patients (1.2%) failed the protocol. Overall, our protocol minimized poor outcomes in patients who have a higher likelihood of complications during anesthetic and airway management.

Introduction

Patients presenting for anesthesia and surgery are increasingly likely to be morbidly obese (MO) (body mass index [BMI] ≥ 35) and super morbidly obese (BMI ≥ 50).¹ Bariatric surgery is now commonly performed in this patient population at most medical centers², and these patients are more likely than leaner patients to develop hypoxemia during interventions following induction-intubation and emergence-extubation, and in the PACU following their anesthetics^{3,4}. In addition, they have a higher incidence of difficulty with visualization of the glottis during intubation, inadequate rescue bag mask ventilation (BMV) during rapid sequence induction-intubation⁵, and obstructive sleep apnea (OSA) predisposing to desaturation events.

Most studies in MO patients have focused their primary outcomes on only a single component of airway management⁶: intubation (I), ventilation (V), or oxygenation (O). In addition, multiple airway devices and anesthetic techniques have been described to address individual issues related to IVO in MO patients.⁷

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The goal of this study was to develop a consensus-based protocol established by clinical anesthesiologists who had extensive experience in the management of MO patients undergoing bariatric surgery. An evidence-based literature review was performed. The reviewed literature focused on MO patients and the management of patients with difficult airway⁸; specifically regarding devices, techniques, and outcomes⁹ with an emphasis on IVO and prevention of aspiration/desaturation events. Subsequently, the protocol was revised and amended to establish airway and anesthetic management in MO patients. Bariatric surgeons at our institution also provided valuable insight to promote the best surgical conditions for patients.

The primary outcome of the study was an evidence-based protocol for induction-intubation utilizing videolaryngoscopy that resulted in endotracheal intubation in ≤ 2 min, avoided the need for BMV, and did not result in a desaturation event ($\text{SpO}_2 < 90\%$). The secondary outcomes measured were the length of time to visualize the vocal cords (T(v)), the length of time from visualization to successful endotracheal intubation (T(i)), the combination of these two times (T(vi)), the necessary manual maneuvers required during BMV, and levels of desaturation that occurred during intubation. Additionally, desaturations at emergence-extubation were also obtained and evaluated.

Methods

After obtaining IRB approval from Wake Forest University Health Sciences and patient written consent, obese patients ($\text{BMI} \geq 30 \text{ kg/m}^2$) scheduled for bariatric surgery (gastric banding, bypass, or sleeve gastrectomy) were recruited for an airway and anesthetic protocol study. Exclusion criteria included: ASA status of 4, $\text{BMI} < 30$, allergies to propofol and/or succinylcholine, and a history of malignant hyperthermia.

The protocol for airway and anesthetic management consisted of three parts of the perioperative period: 1) preoperative preparation with premedication, preoxygenation, and positioning; 2) induction-intubation using video laryngoscopy (VL) and maintenance of anesthesia using isoflurane in air/ O_2 along with infusion of dexmedetomidine as a narcotic sparing technique; and 3) repositioning for emergence-extubation (see appendix 1).

Midazolam 1-2mg IV was administered prior to being transported to the operating room (OR). In the OR, specific positioning was achieved prior to induction-intubation by placing the patients in the Whelan-Calicott position (reverse Trendelenburg with the head section one increment down)¹⁰. In order to establish a more precise placement of patients, the author modified the Whelan-Calicott position to the adapted Whelan-Calicott-Bryan (WCB18), which additionally standardized the bed position at 16-18°.

Patients were pre-oxygenated for four minutes to achieve an $\text{EtO}_2 > 0.8$, and after the first two minutes, fentanyl (100 μg IV) was administered to reduce the hyperdynamic response to VL and intubation. If an $\text{EtO}_2 > 0.8$ was not achieved, an additional two minutes of pre-oxygenation was performed. Intravenous induction was performed with propofol and succinylcholine based on total body weight (TBW) and administered at doses of 1.5 and 1.0mg/kg, respectively. Additional fentanyl was also administered to 1.0 μg /kg TBW (if weight exceeded 100kg).

Intubations were performed using different VL systems as follows: Glidescope® #3, #4, and #5, Storz® DCI #3 and #4, and CMAC® Mac 3, Mac 4, and dBlade™. Personnel performing the intubations were student nurse anesthetists (SRNAs), certified registered nurse anesthetists (CRNAs), anesthesiology residents, and the attending anesthesiologist. The VL utilized was decided by the preference of the clinician performing the intubation and/or determined by device availability. BMV was not planned nor performed unless desaturations occurred or at the discretion of the attending anesthesiologist.

After intubation, 1-2% isoflurane in air and O_2 at 1L/min each were used in addition to an infusion of dexmedetomidine (0.4 μg /kg/hr). Rocuronium for neuromuscular blockade was used for maintenance and additional fentanyl was administered in increments to approximately 1.5 μg /kg for the duration of the procedure. During maintenance, the ventilation mode was either pressure or volume control and additional positive end-expiratory pressure (PEEP) was used.

As the surgical procedure progressed toward removal of the ports, the patients were placed on 100% O_2 and positioned in WCB18° in preparation for emergence from anesthesia.

A size 36 French nasal airway coated with lidocaine (2% or 5%) ointment was inserted into the nare to provide access for ambulatory oxygen with continuous positive airway pressure (CPAP) support immediately following extubation, and to decrease desaturation events during transport to postanesthesia care unit (PACU).

Data were collected independent of the clinicians. Research team members were trained by the research coordinator under the supervision of the principal investigator. Proper training was achieved using video and simulation environments to provide a comprehensive understanding of airway and anesthetic management as it pertains to bariatric patients, the study design, and proper prospective data collection technique. A standardized data collection form was used (see appendix 2).

Patient desaturations were defined as SpO₂ <90% and further divided into SpO₂ 80-89% and <80%. Specific times during VL and intubation were collected: the time from laryngoscope insertion in the mouth to the visualization of the vocal cords (T(v)) on the monitor screen, and the time from visualization of vocal cords on the screen to the insertion of the endotracheal tube (ETT) through the vocal cords (T(i)). Time of confirmation (T(c)) of intubation was also recorded by the presence of the EtCO₂ waveform using capnography. Additionally, the number of attempts to view and to intubate, aids and/or maneuvers used for intubation, as well as the number of BMV adjunct maneuvers (starting with chin lift, and additionally, jaw thrust, placement of an oral airway or two-person BMV, and the application of CPAP >20cmH₂O) were also recorded.

Statistical Analysis

We calculated the mean, standard deviation (SD), and range for age, height, weight, and BMI, and reported 95% confidence intervals (CI) for point estimates. Two-sample t-tests were performed to determine differences in T(v), T(i), and T(vi) between the non-desaturation group and those that did desaturate. A chi-squared test was performed to determine the difference between desaturation incidence in patients with BMI >50 versus those with BMI ≤50, as well as the difference between desaturation incidence for fast T(i) and slow T(i). P-values <0.05 were considered statistically significant.

Results

All 406 patients were safely intubated using videolaryngoscopy. No patients were excluded from the analysis due to protocol deviations. See Table 1 for demographics and type of procedure performed.

Table 1. Demographics (n=406)

Age* (yr)	45.0 (10.1) (23 – 68)	
Weight* (kg)	129.7 (26.0) (82 – 245)	
Height* (cm)	168 (9.4) (110 – 193)	
Body Mass Index*	45.9 (7.7) (31 – 77)	
	Number (n)	Percentage (%)
Gender		
Male	78	19.2
Female	328	80.8
Procedure		
Bypass	229	56.4
Banding	26	6.4
Sleeve	151	37.2
ASA Status		
1-2	101	24.9
3-4	305	75.1
Mallampati		
I/II	347	85.5
III/IV	59	14.5
Thyromental Distance		
<3 Fingerbreadths	50	12.1
3 Fingerbreadths	356	87.7
Range of Motion		
Limited	86	21.2
All	320	78.8

*Age, weight, height, and BMI are shown as the mean (SD) (range)

During induction-intubation, 376/406 patients (92.6%, 95% CI 89.6 – 95.0%) experienced SpO₂ ≥90%, while 30/406 (7.4%, 95% CI 5.0 – 10.4%) experienced SpO₂ <90%. Of the 30 patients who experienced oxygen desaturation during induction-intubation, only four had SpO₂ <80%. These four patients accounted for 1% (95% CI 0.3 – 2.5%) of the 406 patients included in the study, or 13.3% (95% CI 3.8 – 30.7%) of the 30 patients with

oxygen desaturation (Table 2). By examining the group of patients who had a BMI >50, we found a higher level of desaturation during intubation: 13.6% of the patients in this group experienced SpO₂ <90% as opposed to 5.3% for the patients with a BMI ≤50 (P = 0.0055, 95% CI 2.1-16.5%).

During emergence-extubation, 383/406 patients (94.3%, 95% CI 91.6 – 96.4%) experienced SpO₂ ≥90%, while 23/406 (5.7%, 95% CI 3.6 – 8.4%) did not. Three of the 23 patients that desaturated had SpO₂ <80%. These three patients account for 0.74% (95% CI 0.2 – 2.1%) of the total 406 patients, or 13.0% (95% CI 2.8 – 33.6%) of the 23 patients with oxygen desaturation (Table 2). During both induction-intubation and emergence-extubation, there was a similar distribution of severe desaturation (13% of the desaturation group).

Table 2. Oxygen Saturation for Induction/Intubation vs. Emergence/Extubation. Two patients desaturated at both: one had SpO₂ = 80-89% at both periods and the other had SpO₂ <80% at both.

	Induction-Intubation	Emergence-Extubation	
SpO ₂ >90%	376 (92.6%)	SpO ₂ >90%	383 (94.3%)
SpO ₂ = 80-89%	26 (6.4%)	SpO ₂ = 80-89%	20 (4.9%)
SpO ₂ <80%	4 (1%)	SpO ₂ <80%	3 (0.7%)

We found 391/406 patients (96.3%, 95% CI 94.0 – 97.9%) required ≤2 min to intubate, while 15/406 (3.7%, 95% CI 2.1 – 6.0%) required >2 min. We also found that the group of patients who did not desaturate during intubation required a statistically significant decreased time to visualize the vocal cords and to place the ETT (Table 3a and b; Figure 1).

Table 3a. Times and Saturations

	SpO ₂ ≥90%	SpO ₂ <90%	P-value
T(v) (sec)*	14.3 (10.0)	23.6 (22.9)	0.0175
T(i) (sec)*	21.4 (19.5)	42.6 (42.6)	0.0056
T(vi) (sec)*	35.7 (23.6)	66.2 (31.9)	0.000007
T(c) (sec)	29.2 (9.4)	28.5 (10.0)	0.713

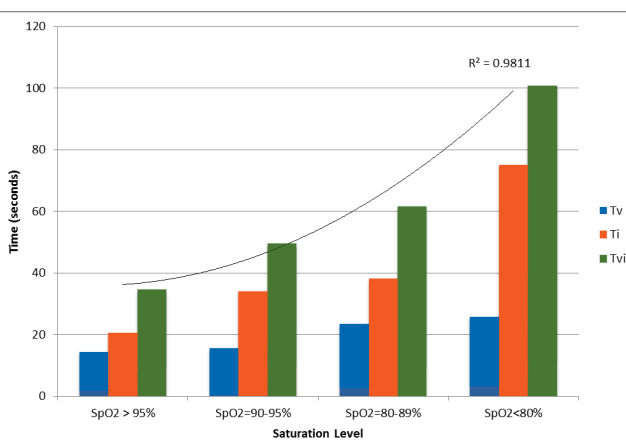
T(v) = visualization time; T(i) = ETT intubation time; T(vi) = T(v)+T(i). T(v), T(i), and T(vi) were not significantly different between level of oxygen desaturation (P = 0.385, 0.052, and 0.054, respectively)

Table 3b. Times and Saturations

	No Oxygen Desaturations		Oxygen Desaturations*	
	SpO ₂ >95%	SpO ₂ = 90-95%	SpO ₂ = 80-89%	SpO ₂ <80%
T(v) (s)	14.2 (10.1)	15.6 (9.5)	23.4 (24.2)	25.7 (11.9)
T(i) (s)	20.5 (17.8)	33.9 (32.5)	38.1 (29.3)	75.0 (32.7)
T(vi) (s)	34.7 (22.4)	49.5 (33.6)	61.5 (39.2)	100.7 (35.3)

T(v) = visualization time; T(i) = ETT intubation time; T(vi) = T(v)+T(i); T(c) = EtCO₂ confirmation time; T(v), T(i), and T(vi) were statistically significantly reduced in the group of patients that did not desaturate

Figure 1. Saturation levels at intubation. Tv = visualization time; Ti = endotracheal intubation time; Tvi = Tv + Ti. Each bar represents the average times for all patients in each saturation level group (>95%, 90-95%, 80-89%, and <80%). The lower the SpO₂ level, the longer each time was.



The mean visualization time (T(v)) was 15s and the mean intubation time (T(i)) was 23s. T(v) was divided into fast (<15s) and slow (>15s). Similarly, T(i) was divided into fast (<23s) and slow (>23s). When T(i) was fast, the overall incidence of desaturation was 2.9% compared to the incidence of desaturation when T(i) was slow: 13.8%. Therefore, the incidence of desaturation was significantly lower when T(i) was fast compared to when T(i) was slow (P = 0.000017, 95% CI 5.2-18.2%). Additionally, when T(i) was fast, the incidence of desaturation was not significantly different between the fast T(v) group and the slow T(v) group (P = 0.34) (Table 4). This indicated that T(i) may be more critical than T(v) when it comes to reducing desaturation events.

		T(i)	
		Fast	Slow
T(v)	Fast	190 SpO ₂ <90%: 5/190 (2.6%)	61 SpO ₂ <90%: 5/61 (8.2%)
	Slow	85 SpO ₂ <90%: 3/85 (3.5%)	62 SpO ₂ <90%: 12/62 (19.4%)

Table 4. Prevalence of Desaturation in Time Intervals for T(v) and T(i). T(v) = visualization time; T(i) = ETT intubation time. The choice of quadrant for each intubation was determined by examining the mean times for T(v) and T(i) for the whole group. Intubations with T(v) <15s and/or T(i) <23s were considered “fast,” while those over that were “slow.” Times were not recorded for eight patients.

During induction-intubation, 7/406 patients (1.7%, 95% CI 0.7 – 3.5%) required BMV as rescue due to either the time it took to intubate or the incidence of desaturation. These patients were either rescued with BMV due to a documented desaturation event, or the attending anesthesiologist decided to return to BMV before the desaturation started to occur.

There were 5/406 (1.2%, 95% CI 0.4 – 2.9%) who had problems with all IVO criteria: >2 min to intubate, had to be rescued with BMV, and had SpO₂ <90%. There were 8/406 (2.0%, 95% CI 0.9 – 3.8%) who took >2 min to intubate and experienced SpO₂ <90%. Eight of the 15 patients (53.3%, 95% CI 26.6 – 78.7%) who took >2 min to intubate experienced oxygen desaturations. Patients who took >2 min to intubate, required BMV, or experienced oxygen desaturation were deemed as protocol failures (Table 5).

Table 5. Protocol Failures by Category. I = intubation; V = ventilation; O = oxygenation; BMV = bag mask ventilation.

	Total #	Failed I Alone	Failed V Alone	Failed O Alone	Failed I & V	Failed I & O	Failed IVO
Intubation > 2 min	15	5	0	0	2	3	5
Required BMV	7	0	0	0	2	0	5
SpO₂ <90% during intubation	30	0	0	22	0	3	5

Discussion

Our study found that by following a consensus-based protocol, the incidence of hypoxemia was decreased in MO patients undergoing elective gastric bypass, banding, and sleeve gastrectomies. All 406 patients were safely intubated using VL by clinicians with varying degrees of experience and

expertise. However, 9% of patients required >2 min to intubate, BMV, and/or suffered a desaturation event (SpO₂ <90%). Five patients failed all three outcomes; thus, failed the protocol. These five patients did not have any common demographic or airway indicators to explain their challenges during intubation. The highest incidence of secondary outcome failures was comprised of the patients who desaturated. Even though those who desaturated accounted for the largest number of failures, they did not make up a large percentage of the whole study group; only 30 of our patients desaturated.

Fifteen patients required >2 min to intubate. In a fraction of these cases, the lengthy attempt at visualization and intubation led to a desaturation event with an associated need for rescue BMV. We avoided BMV as a part of our protocol based on surgical recommendations against potential gastric insufflation; however, when required as a rescue technique, no difficult ventilation encounters were recorded. The issues with intubation may have been due to variations in the clinicians’ level of experience and familiarity with the VL device.¹¹

The times taken to visualize the vocal cords and place the ETT were crucial in determining the other primary outcomes (BMV and desaturations). The majority of the difficult intubations were caused by clinicians having trouble maneuvering the ETT into the trachea. No study has isolated one stylet as superior to another¹², so we allowed for the use of malleable and non-malleable stylets in our study. We used three different types of VLs and found no variance in success rates between the various systems. This means the difficult

intubations may have been caused by a combination of other factors, such as anatomical differences in the patients’ airways (i.e., large tongue, redundant tissue, etc.), inappropriate blade size, and/or the clinician’s experience level.

From our clinical experience and review of the literature, a quick intubation was vital for a successful and safe outcome. Our T(v) and T(i) differed slightly from other studies¹³, but gave us the best opportunity to analyze the time throughout intubation by combining T(v) and T(i) as T(vi). We addressed the incidence of desaturation that occurred as either or both times increased. Although T(i) appeared to be a greater indicator of outcome success, it was important to examine both times together since the worst outcomes arose when both the visualization and intubation times were slow.

We compared our results to previous morbid obesity and airway device studies in patients with difficult airways. The mean BMI of our patients was 45.9. Brodsky found that MO patients were not harder to intubate, and their subject group had a median BMI of 47.5.⁶ Even though their patients represented a similar group of patients undergoing elective bariatric surgery, they only used direct laryngoscopy.⁶

Our patients experienced a lower incidence of desaturation during intubation than previously stated levels.³ Juvin³ compared lean and obese patients and determined that there was an increased incidence of desaturation in obese patients. While we could not compare our results to a lean group, given the nature of bariatric surgery, we subdivided our patients into MO and super MO (SMO). We found a higher level of desaturation during intubation in patients with a BMI >50. Our results contradict the findings of Leykin⁸ who found no significant difference in outcomes between MO and SMO patients.

While many previous studies focused on either induction-intubation or emergence-extubation⁴, we examined both periods. Upon initial review, we found that there were more complications during emergence, so we improved our protocol by standardizing the patient positioning during this period to decrease oxygenation complications using the WCB18 position at both time periods. After standardizing emergence-extubation in our protocol, desaturation events were no more likely during that period of the procedure than during induction-intubation.

In addition, limiting narcotics in a high-risk group with high incidence of OSA was important for a safe intubation.¹⁴ However, patients with chronic pain syndromes or on prescribed narcotics were allowed to receive fentanyl

preoperatively. Positioning for MO patients has been studied; however, it often involved placing many blankets and pillows to obtain the ear-sternum ideal angle.¹⁵ Boyce¹⁵ found that a bed angle of 30°-reverse Trendelenburg led to fewer desaturations and the shortest time to return SpO₂ to 97%. However, we found 30° to be too steep and awkward for induction-intubation. By using the WCB18, we provided safe induction-intubation conditions and eliminated the use of blankets and pillows. For induction, we used succinylcholine to gain expedited intubation conditions and based our dosage on the findings of Lemmens and Brodsky¹⁶ who used 1mg/kg using TBW.

Our findings were similar to Aziz¹⁷ and Andersen¹⁸ who found that the Glidescope® provided quicker views and was a better option for intubation. However, we agreed with their assertion that a quicker view did not necessarily lead to an easier intubation.^{17,18} We planned the use of flexible fiberoptic bronchoscopy (FFB) and the AirQ® laryngeal mask (as a conduit) in our protocol as an emergency intubation technique. The VL was chosen as the primary technique since our subject group had a high risk of GERD and potential aspiration.¹⁹ As noted previously, we also used a variety of malleable and non-malleable stylets to assist the placement of the ETT. This method was suggested by Cooper as a way to assist in the intubation.²⁰

Boyce¹⁵ found that using BMV for MO patients could be problematic, but that was not the case for our study. In fact, due to our limited number of BMV patients, we could not truly compare our data with that of the literature stating the difficulty to ventilate MO patients. For maintenance, we chose to use isoflurane and dexmedetomidine as a narcotic sparing technique. These recommendations came from both Feld²¹ and Boyce¹⁵. In addition, unlike other studies that limit the level of clinician^{3,6}, our protocol was able to be used by all levels of clinicians with the guidance of attending anesthesiologists.

A recent national survey on the use of VL noted that the choice of device is not usually based on the literature²²; however, we have shown that the use of VL in MO patients did result in decreased desaturations as a marker of poor outcomes. Additionally, in a systematic review, Lewis²³ stated that the use of VL was not associated with incidence of desaturation nor did it affect the time required for intubation. Our study, however, found that there was an intubation time associated

with limiting desaturation events in obese patients.

There were several limitations to our study. We were limited to collecting data at one institution; thus, we were limited to three surgeons in a variety of operating rooms. We allowed all levels of anesthesia providers to partake in the intubation of the patients. We used a combination of different blades with three different VL devices and did not randomize the use of these instruments. During ventilation and maintenance, volume and pressure control were not standardized unless the SpO₂ was <90%.

Our study focused on developing a protocol for MO patients undergoing bariatric surgery, which enhanced the success of intubation, and also avoided the need for BMV and decreased the incidence of desaturation. While the protocol was tailored to healthy MO patients undergoing bariatric procedures, it may serve as a general guideline for future MO patients undergoing other surgical procedures. In conclusion, we developed a protocol for a subset of patients that are known to be potentially difficult to intubate and/or experience an increased risk of hypoxemia events. We showed that all patients were able to be intubated successfully using VL and we associated the intubation time that prevented severe desaturation events.

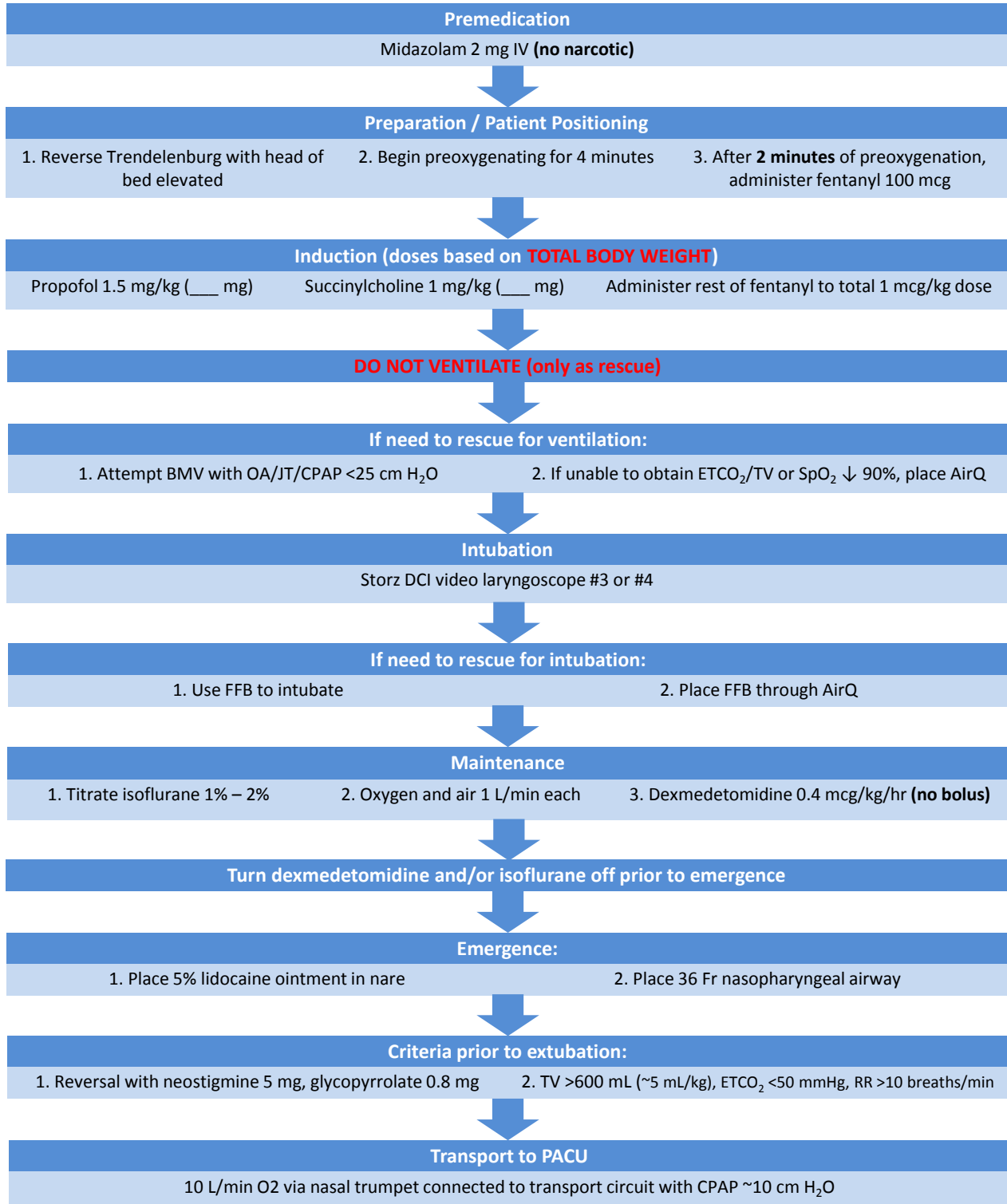
Disclosures

No financial support given. Authors report no conflicts of interest.

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Appendix 1. Gastric bypass / banding (GB3) study: Anesthetic protocol



Appendix 2. Gastric Bypass/Banding (GB3) Study: Datasheet page 1

Subject #: _____

[Insert patient sticker here]

Gastric bypass/banding (GB3) study datasheet

Service date: _____ Age (yrs): _____ Weight (kg): _____ Height (cm): _____ BMI: _____
 Gender: M F ASA Status: _____

Diagnosis: _____
 Procedure: _____

Preparation

History of difficult airway? Yes No

If yes:

- By history on chart
- Patient/family statement
- Physical Exam
- Other: _____

Airway exam:

- Mallampati Class: I II III IV
- Mouth Opening: ____ FB
- Thyromental distance: ____ FB
- Neck extension/flexion: all some none
- Other: _____

Midazolam (mg): _____

Time moving from stretcher to OR bed: _____
(Place in W-C position to placement of ASA monitors)

Time of beginning preoxygenation: _____
(Mask is placed on the patient's face, 100% O₂ at 10 L/min)

Induction

Initial fentanyl administration time (100 mcg): _____
(After 2 minutes of preoxygenation)

Induction time: _____
(After 4 minutes of preoxygenation)

Administration of induction agents (based on TBW):

1. Propofol (1.5 mg/kg): _____

2. Succinylcholine (1 mg/kg): _____

3. Fentanyl (mcg): _____
(Administer additional fentanyl to total 1 mcg/kg)

Intubation

VL blade size: _____
(Size 3 or 4)

Time of intubation: _____
(Time on clock)

Intubation times

(Press Silence Alarm button to read "2:00")

Recorded time on anesthesia machine monitor	Time duration (in seconds)
Placement of video laryngoscope in the mouth: <u>02:00</u>	--
Visualization of vocal cords on monitor: _____	
Placement of the ETT through the vocal cords: _____	
Verification of ETCO ₂ waveform on the monitor: _____	

Total time: _____

Appendix 2. Gastric Bypass/Banding (GB3) Study: Datasheet page 2

Problems / events during intubation: _____

Rescue

Bag mask ventilation required? Yes No

If yes: Unable to obtain ET_{CO}₂

SpO₂ < 90%

AirQ placed (size): _____

FFB required to intubate? Yes No

If yes: FFB type/size: _____

Maintenance

1. Isoflurane titrated 1 – 2% with O₂ and air 1 L/min
2. Dexmedetomidine 0.4 mcg/kg/hr (no bolus)

Incision time: _____

(Procedure start time)

Problems/ events during maintenance: _____

Emergence/extubation

Surgical end time: _____ Extubation time: _____

1. Reversal- neostigmine 5 mg, glycopyrrolate 1 mg
2. Extubation criteria: TV > 600 mL, ET_{CO}₂ < 50 mm Hg, RR > 10 breaths/min

Time leaving the OR: _____
(Transport with 10 L/min O₂ via nasal trumpet)

Arrival to PACU: _____

Problems/events during extubation: _____

PACU/Post-op

Pain and PONV medications administered in PACU (type/dose): _____

Discharge date from the floor: _____ Discharge time from the floor: _____

Pain and PONV medications administered on the floor (type/dose): _____

Protocol adjustments? Yes No

If yes, explain: _____

