

5-2019

Lack of Association Between Tidal Volume and Postoperative Pulmonary Complications in Morbidly Obese Patients

Carlos E Guerra

Donald Penning

Xiaoxia Han

David Boy

Lack of Association Between Tidal Volume and Postoperative Pulmonary Complications in Morbidly Obese Patients

**Carlos Guerra, M.D; Donald
Penning, M.D., PhD.**

Department of Anesthesiology,
Pain Management and
Perioperative Medicine
2019



Background

- Severe grades of obesity are poorly represented in the cumulative evidence recommending the use of low tidal volumes (TV).
- These patients are particularly prone to receive higher TV when adjusted for ideal body weight (IBW).
- A low TV strategy has never been tested in this population.

Objective

- To explore the effect of TV on the postoperative pulmonary outcome of morbidly obese patients, as well as its implications on intraoperative ventilatory settings.

Methods

- Retrospective, single-center study.
- IRB approved.
- Inclusion criteria:
 - Adults (>18 years old).
 - BMI of at least 40 Kg/M².
 - Abdominal surgery of at least 120 minutes.
 - Intubated for the procedure and extubated at the end of the procedure.
 - Admitted for postoperative care.
- Exclusion criteria:
 - Cardiac, Thoracic, Neurosurgical, vascular, head/neck, and other non/abdominal surgeries.
 - Obstetric Procedures / Non abdominal GYN procedures (D&C).

Variables

- Demographic and clinical characteristics, Intraoperative ventilation variables, type and duration of surgery.
- 30-day Postoperative PPCs, via ICD-10 diagnoses as well as unplanned ICU admission, intubation and postoperative oxygen requirement.
- Primary Outcome: Weighed Composite Pulmonary complication score and its relationship with adjusted TV (TV/IBW).
- Secondary Outcome: Relationship between TV/IBW and other intraoperative ventilatory variables.

Results

- 961 surgeries met the SQL query criteria. Only 852 were finally included in the analysis.
- 8.3% (71/852) experienced at least one PPC.

Table 1. Baseline Characteristics

Category	All Patients (n=859)	PPCs: Yes (n=71)	PPCs: No (n=788)	P-value	
	3	759 (88.4)	63 (88.7)	696 (88.3)	<0.001
	4	18 (2.1)	6 (8.5)	12 (1.5)	<0.001
	5	1 (0.1)	1 (1.4)	0 (0)	<0.001
Sex	Female	714 (83.1)	59 (83.1)	655 (83.1)	1
	Male	145 (16.9)	12 (16.9)	133 (16.9)	1
Emergency Surgery	No	824 (95.9)	63 (88.7)	761 (96.6)	0.006
	Yes	35 (4.1)	8 (11.3)	27 (3.4)	0.006
Race	Black	367 (42.7)	30 (42.3)	337 (42.8)	0.878
	Other/Unknown/Decline	86 (10)	6 (8.5)	80 (10.2)	0.878
	White	406 (47.3)	35 (49.3)	371 (47.1)	0.878
Surgery	Peripheral (Non-upper abdominal)	286 (33.3)	45 (63.4)	241 (30.6)	<0.001
	Upper Abdominal	573 (66.7)	26 (36.6)	547 (69.4)	<0.001
BMI	<50	634 (73.8)	49 (69)	585 (74.2)	0.413
	≥50	225 (26.2)	22 (31)	203 (25.8)	0.413
Age (years)	≤50	495 (57.6)	28 (39.4)	467 (59.3)	<0.001
	>80	1 (0.1)	1 (1.4)	0 (0)	<0.001
	51-80	363 (42.3)	42 (59.2)	321 (40.7)	<0.001
Duration of Surgery (hours)	≤2	308 (35.9)	13 (18.3)	295 (37.4)	<0.001
	>2 to 3	333 (38.8)	21 (29.6)	312 (39.6)	<0.001
	>3	218 (25.4)	37 (52.1)	181 (23)	<0.001
Recent Respiratory Infection	No	846 (98.5)	68 (95.8)	778 (98.7)	0.085
	Yes	13 (1.5)	3 (4.2)	10 (1.3)	0.085
Preoperative Anemia	No	820 (95.5)	59 (83.1)	761 (96.6)	<0.001
	Yes	39 (4.5)	12 (16.9)	27 (3.4)	<0.001
Pulse Oximetry (%)	≤90	4 (0.5)	0 (0)	4 (0.5)	0.107
	≥96	751 (87.4)	57 (80.3)	694 (88.1)	0.107
	91-95	104 (12.1)	14 (19.7)	90 (11.4)	0.107
ARISCAT Category	High	23 (2.7)	7 (9.9)	16 (2)	0.001
	Low	414 (48.2)	26 (36.6)	388 (49.2)	0.001
	Medium	422 (49.1)	38 (53.5)	384 (48.7)	0.001
Chronic Heart Failure	No	844 (98.3)	67 (94.4)	777 (98.6)	0.029
	Yes	15 (1.7)	4 (5.6)	11 (1.4)	
Asthma	No	813 (94.6)	62 (87.3)	751 (95.3)	0.01
	Yes	46 (5.4)	9 (12.7)	37 (4.7)	
Cirrhosis	No	854 (99.4)	70 (98.6)	784 (99.5)	0.351
	Yes	5 (0.6)	1 (1.4)	4 (0.5)	
COPD	No	836 (97.3)	65 (91.5)	771 (97.8)	0.008
	Yes	23 (2.7)	6 (8.5)	17 (2.2)	

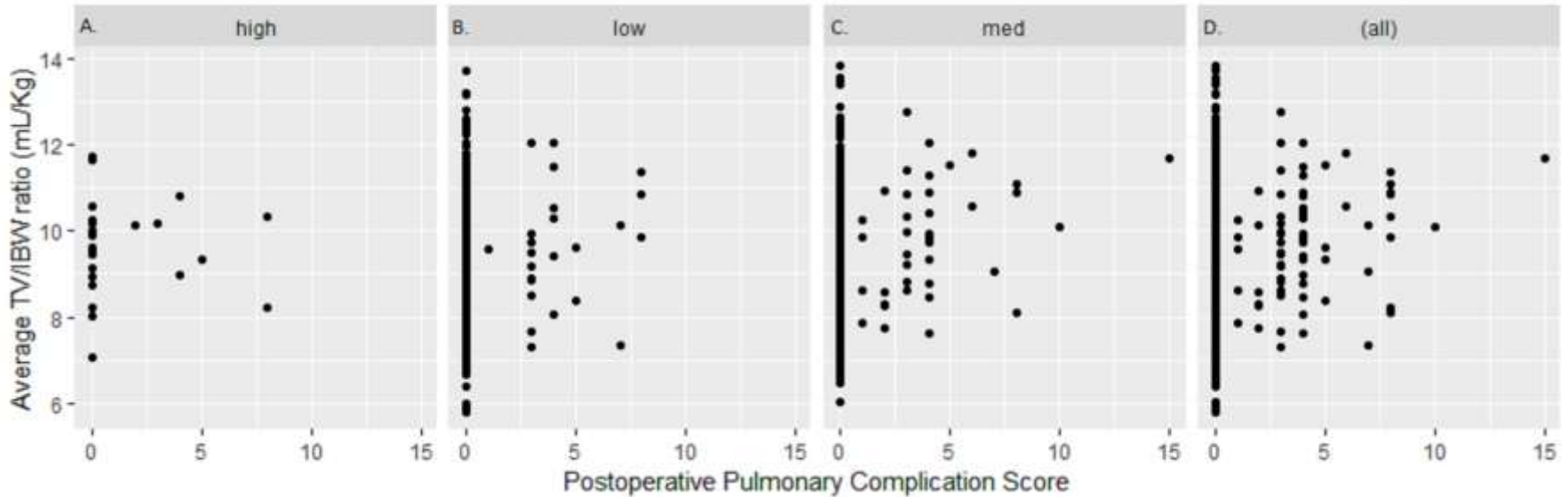
Results

Table 2. Intraoperative Variables

	All Patients n=859		PPCs: Yes (n=71)		PPCs: No (n=788)		P-value
	Mean (SD)	Median (Q1-Q3)	Mean (SD)	Median (Q1-Q3)	Mean (SD)	Median (Q1-Q3)	
IBW (Kg)	58.32 (9.87)	57 (52.4-62.75)	56.35 (10.04)	54.7 (50.1-61.6)	58.5 (9.84)	57 (52.4-63.53)	0.032
Duration (hours)	3.07 (1.18)	3 (2-4)	3.83 (1.59)	4 (3-4)	3 (1.11)	3 (2-3)	<0.001
SpO2 (%)	97.41 (3.29)	98 (96-99)	96.9 (2.29)	97 (96-98.62)	97.45 (3.36)	98 (96-99)	0.04
ARISCAT score	25.49 (9.9)	26 (16-34)	29.27 (10.71)	26 (23-34)	25.15 (9.76)	26 (16-31)	0.003
TV (mL)	542.47 (63.6)	549 (508-584.5)	539.07 (58.38)	544 (517-575)	542.78 (64.08)	549 (508-586)	0.469
TV/IBW ratio	9.47 (1.41)	9.5 (8.39-10.39)	9.73 (1.29)	9.72 (8.69-10.68)	9.44 (1.42)	9.49 (8.34-10.36)	0.094
PEEP	5 (0.83)	5 (5-5)	5.08 (1)	5 (5-5)	4.99 (0.82)	5 (5-5)	0.609
FiO2 (%)	80.96 (15.15)	88 (69-94)	81.38 (14.78)	86 (68-94)	80.92 (15.19)	89 (69-94)	0.675
PIP	28.97 (4.11)	29 (26-32)	28.65 (4.05)	29 (26-31)	29 (4.12)	29 (26-32)	0.592
ETCO₂	34.75 (2.76)	34 (33-36)	34.07 (2.91)	33 (32-36)	34.81 (2.74)	34 (33-36)	0.01
RR	12.95 (1.74)	13 (12-14)	12.8 (1.72)	13 (12-14)	12.96 (1.75)	13 (12-14)	0.471

Results

Figure 1. Relationship Between TV/IBW and PPC score



Spearman's rho

0.061, $p=0.076$

0.025, $p=0.611$

0.086, $p=0.078$

0.074, $p=0.738$

Results

Figure 2. Relationship Between TV/IBW and other Intraoperative Ventilatory Variables

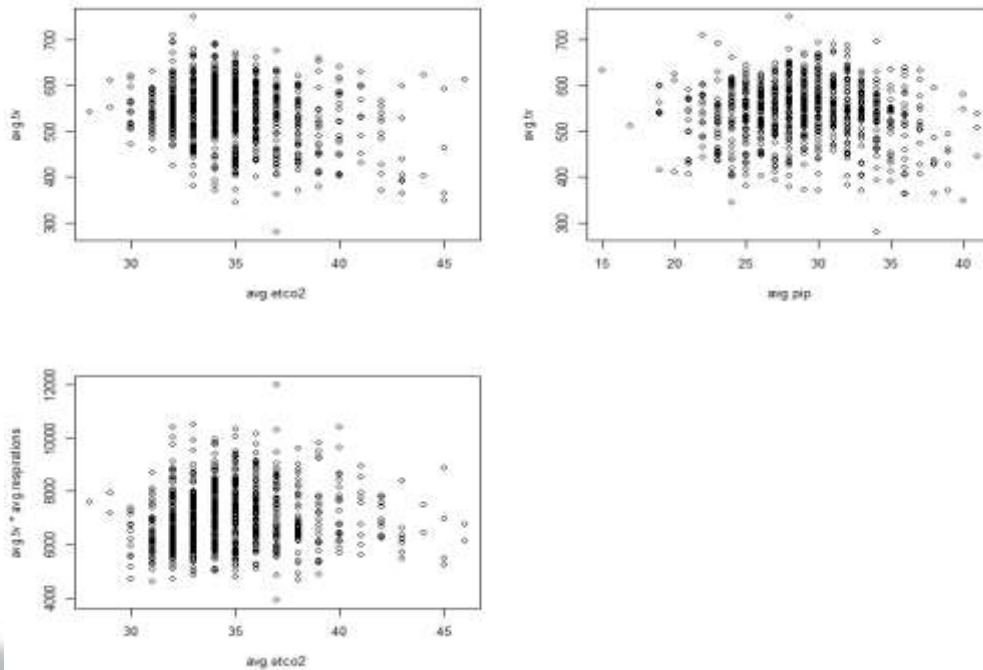


Table 3. Frequency of Postoperative Pulmonary Complications by ARISCAT risk category

ARISCAT	PPC: Yes Frequency (%)	PPC: No Frequency (%)	p-value*
Low	388 (49.2)	26 (36.6)	0.0013
Medium	384 (48.7)	38 (53.5)	
High	16 (2)	7 (9.9)	

Strengths and Limitations

- Electronic, automated data collection.
- Largest sample to date.
- Clinically significant outcomes.
- Accurate ventilation data.
- Estimation and differentiation of preoperative pulmonary risk.
- Retrospective methodology (intrinsic bias).
- Outcomes based on ICD-10 diagnoses.
- Data not adjusted for laparoscopic vs open procedures.
- Inability to adjust for other covariates.

Conclusion

- Tidal volume was not correlated to an increased frequency or severity of postoperative pulmonary complications in morbidly obese patients undergoing prolonged abdominal surgery.
- The optimal ventilation strategy for this population is still unclear, especially when referring to TV.
- We propose the outcomes of future prospective studies should continue to be clinical and weigh the severity of complications, ultimately influencing clinical practice.