



## **XXVI IFSO WORLD CONGRESS OF BARIATRIC & METABOLIC SURGERY**

**NAPOLI, ITALY | Mostra d'Oltremare**

### **The Morbidly Obese Patient Undergoing Robotic Abdominal Surgery**

Rainer Lenhardt, USA

# Outline

- A. Indications and advantages of robotic surgery**
- B. Pulmonary function of morbidly obese patients and robotic abdominal surgery**
- C. Ventilator and paralysis management**



# Indications for Robotic Abdominal Surgery

1. **Bariatric surgery**
2. **Prostatectomy (RALPR)**
3. **Nephrectomy**
4. **Cystectomy (RARC)**
5. **Colo-rectal surgery**
6. **Gynecological surgery**

# Advantages of Robotic Surgery

1. Reduced blood loss
2. Reduced postoperative pain
3. Reduced hospital stay
4. Faster return to urinary and bowel function
5. Reduction in surgical complications
6. Costs ???

Healing et al. Obstet Gynecol Scand 2016 95:299

# Advantages of Robotic Surgery

## Robotic hysterectomy vs. total abdominal hysterectomy

	RHE	TAH
Duration of surgery (min)	141 ± 56	128 ± 58
LOS (days)	0.9 ± 0.9	3.2 ± 1.4
Estimated blood loss (ml)	125 ± 169	264 ± 270
30 day SSI rate (%)	1.4	8.5



# Diseases linked to Obesity

## Cancer

- Breast
- Prostate
- Colorectal
- Renal
- Endometrial



# Diseases linked to Obesity

## OB/GYN

- Endometrial
- Uterine fibroma
- Ovarian cysts
- Cesarean section
- Fibroadenoma of the breast



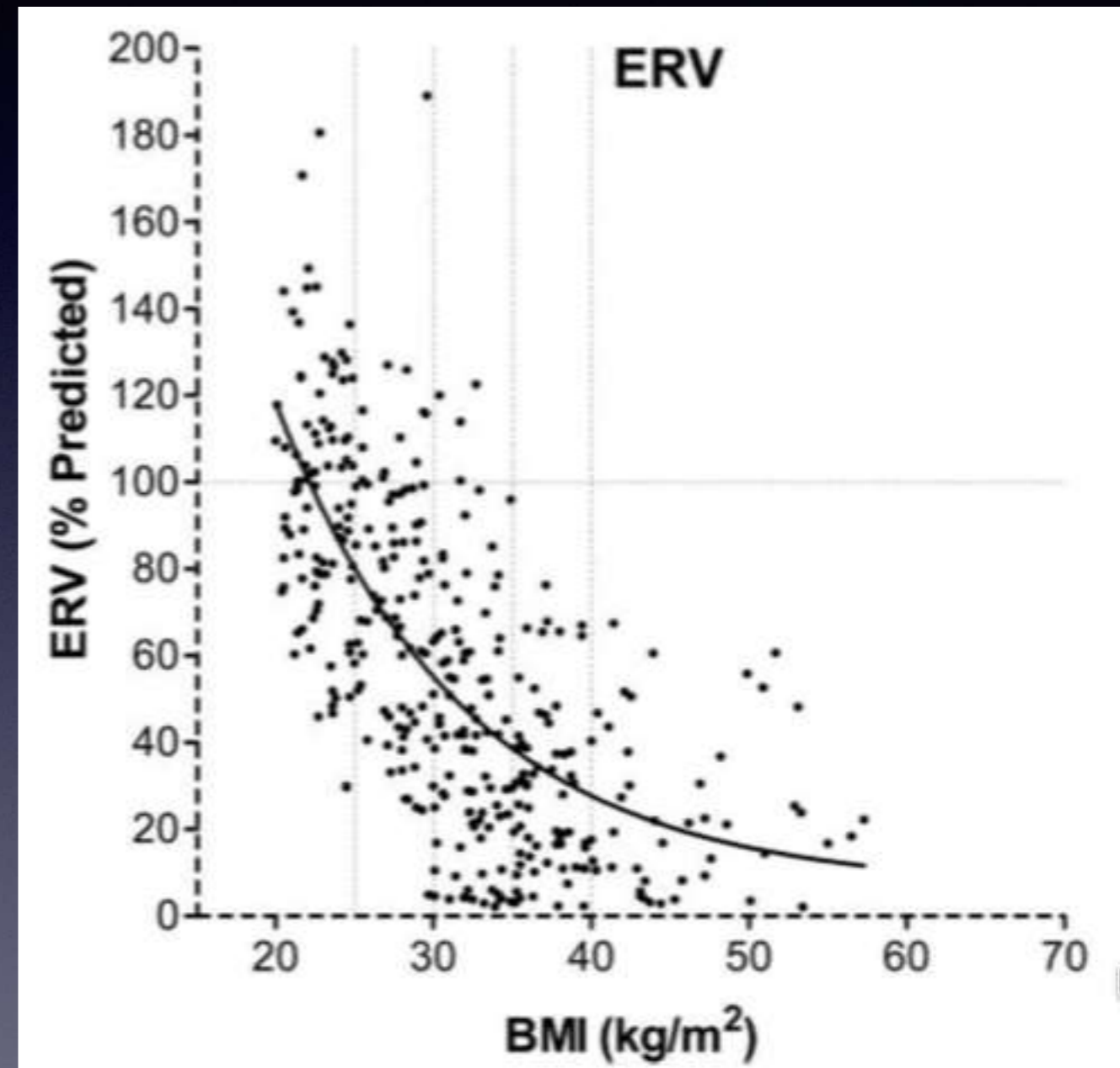
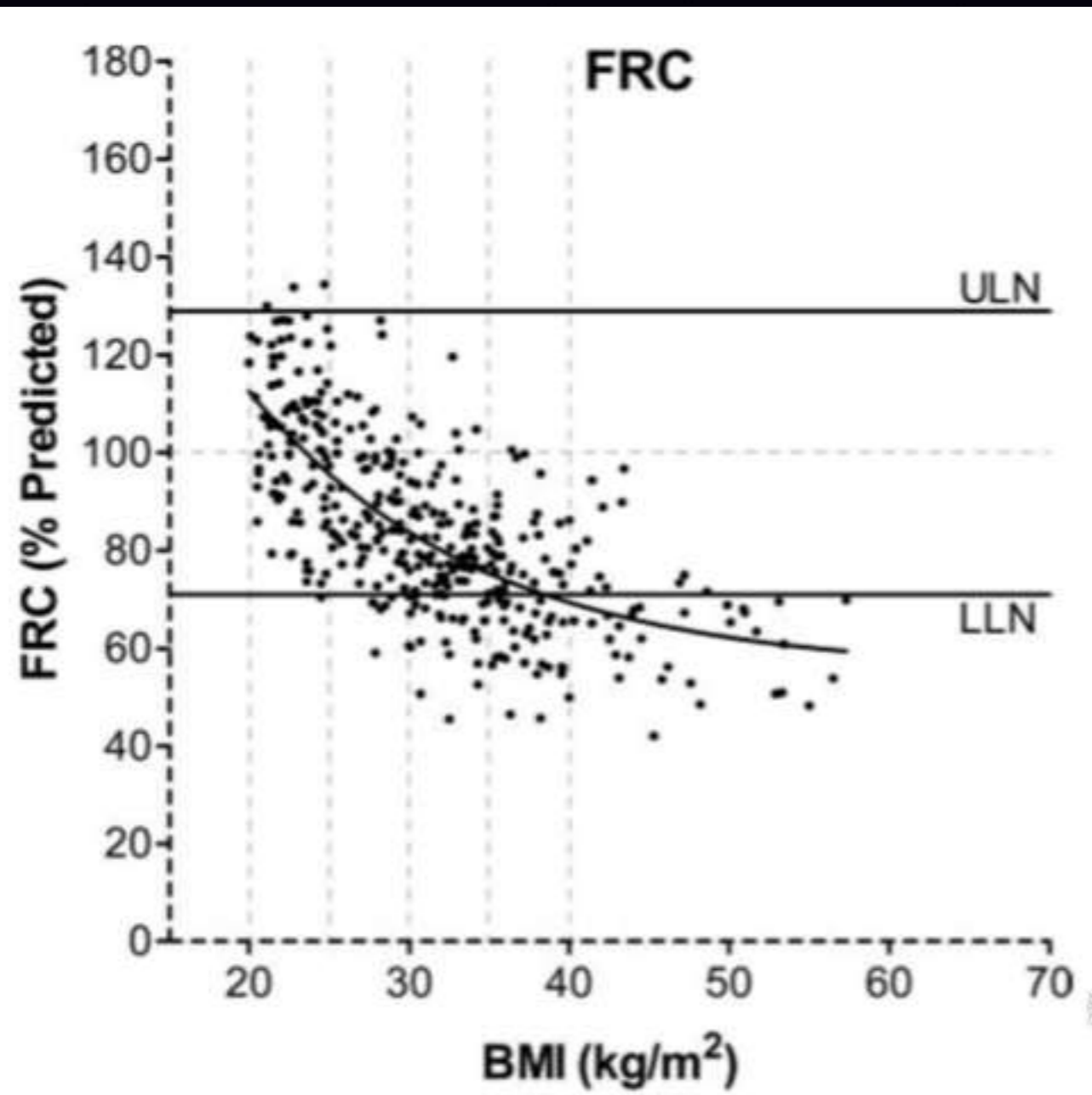


# Respiratory System

- Extra pressure on thorax → ↓ compliance
  - ↓ Compliance → airway pressures
  - Airway pressure → risk of barotrauma



# FRC and ERV



Jones et al. CHEST 2006; 130:827  
Murphy et al. Can J Anaesth 2013; 60:929







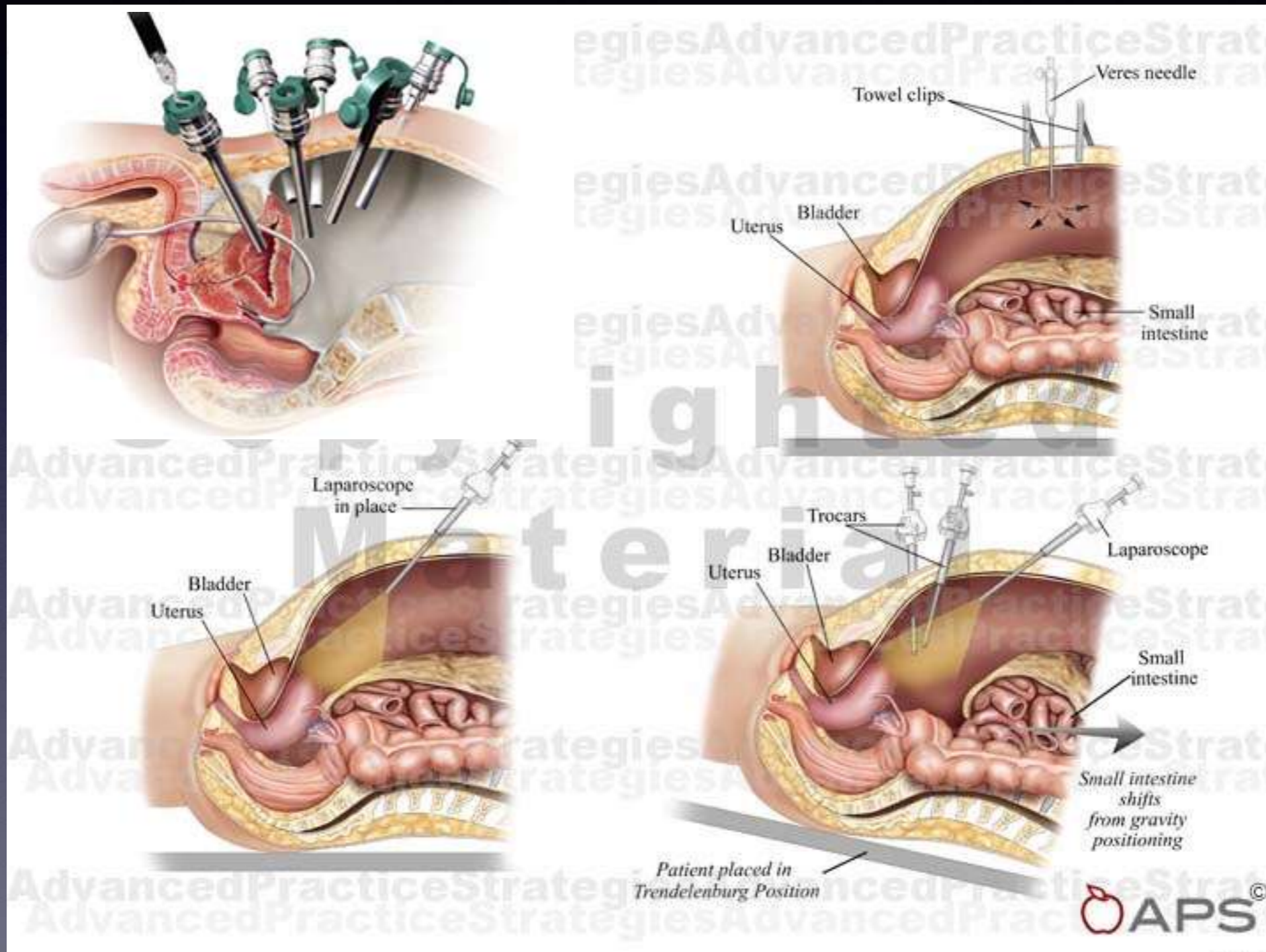
da Vinci Xi





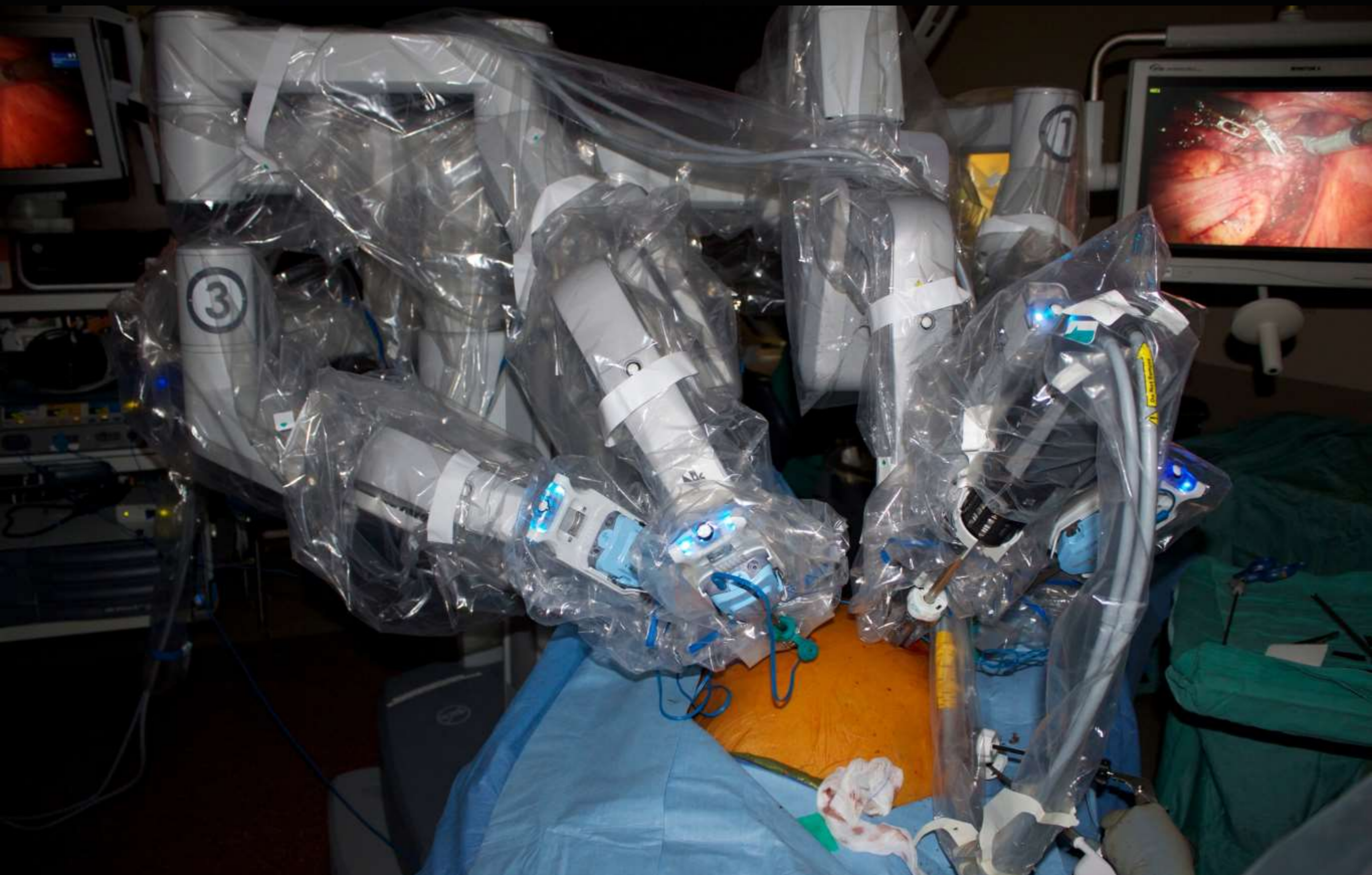


# Robotic Surgery





# Robotic Surgery





# Pulmonary Changes

## Effects on respiratory mechanics

- Increased inspiratory peak and plateau airway pressure
- FRC and lung compliance reduced (>50%)
- Increase in end-tidal CO<sub>2</sub> tension

# Pulmonary Changes

- **Most of the lung below left atrium in zone 3 and 4 condition**
- **Ventilation-perfusion mismatch**
- **Atelectasis**
- **Pulmonary interstitial edema**



# Complications of Robotic Surgery

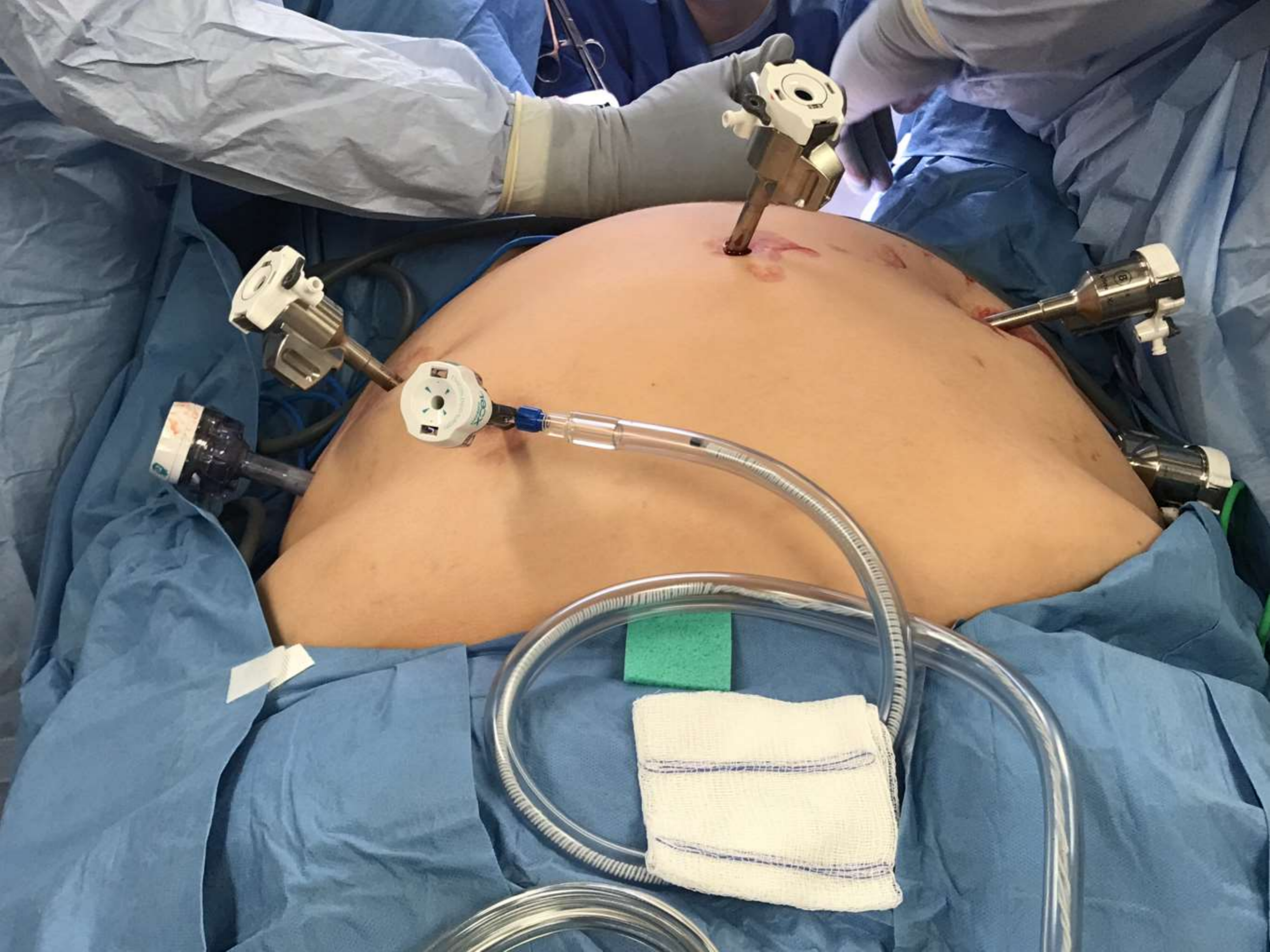
1. **Pulmonary changes:**  
Hypercarbia and hypoxia
2. **Pneumothorax, pneumo-mediastinum**
3. **Airway and face edema**
4. **Subcutaneous emphysema**
5. **Gas embolism**
6. **Cardiovascular changes:**  
BP changes, HR changes
7. **Increase of ICP and IOP**

# Complications of Robotic Surgery

**Pulmonary changes:**

**Hypercarbia and hypoxia**







Set Pressure  
mm Hg



15



Actual Pressure  
mm Hg

13



307  
Liter

Set Flow  
l/min



40



Insufflation: High Flow

Mode  
High Flow

STOP

Actual  
13 l/min



# Ventilation Strategies

## Protective ventilation

- **Vt 6-8ml/kg**

Young et al. Br J Anaesth 2019; 123:898

- **PEEP 6-8 cm/H<sub>2</sub>O**

- **Recruitment maneuver Q30min**

Cheng et al. BMC Anesthesiology 2022 12;22:347

- **I:E ratio 1:1 or 2:1**

Kim et al. Act Anaesthesiol Scand 2013; 57:613

- **PC-VG or PRVC**

Kim et al. Int J Med Sci 2018; 15:1526

# Acceleromyometer

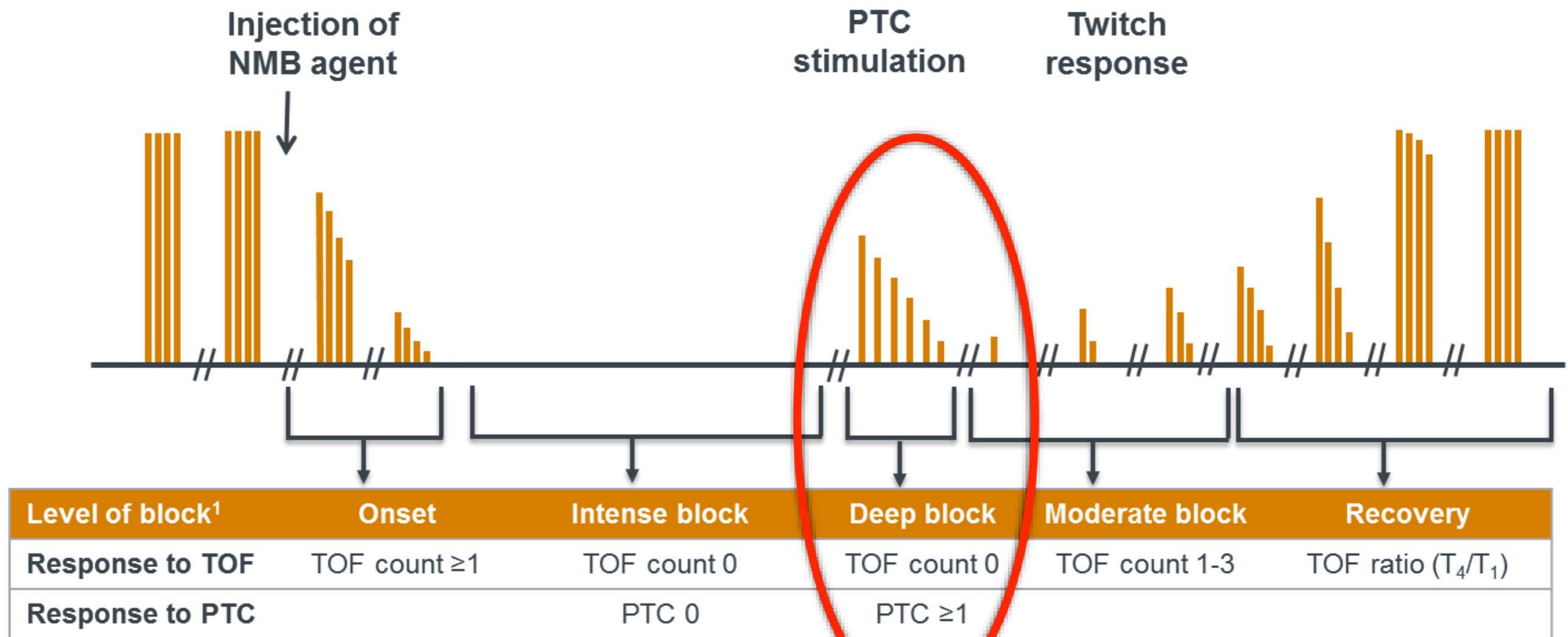


M. adductor pollicis

Thilen S et al. *Anesthesiology*. 2012;117:964



# Neuromuscular Monitoring During Robotic Surgery



Fuchs-Buder et al. *Minerva Anest* 2018; 84:509

# Robotic Surgery in Obese Patients





# Scale

<p><b>Extremely poor conditions:</b> The surgeon is unable to work due to coughing or due to the inability to obtain a visible laparoscopic field because of inadequate muscle relaxation</p>	<b>1</b>
<p><b>Poor conditions:</b> There is a visible laparoscopic field but the surgeon is severely hampered by inadequate muscle relaxation continuous muscle contractions and/or movements with the hazard of tissue damage</p>	<b>2</b>
<p><b>Acceptable conditions:</b> There is a wide visible laparoscopic field but muscle contractions and/or movements occur regularly causing some interference with the surgeon's work</p>	<b>3</b>
<p><b>Good conditions:</b> There is a wide laparoscopic working field with sporadic muscle contractions and/or movements</p>	<b>4</b>
<p><b>Optimal conditions:</b> There is a wide visible laparoscopic working field without any movement or contractions</p>	<b>5</b>

# Surgical Conditions in Robotic Surgery Obese versus non-Obese Patients

## Robotic hysterectomy, n=100

**BMI 25.8**

**BMI 43**

<b>Leiden surgical rating scale</b>	<b>BMI &lt; 29.9</b>	<b>BMI &gt; 30</b>
<b>Pooled data M + D paralysis</b>	<b>4.5 ± 0.5</b>	<b>3.5 ± 0.8</b>
<b>Pooled data M paralysis</b>	<b>4.4 ± 0.4</b>	<b>3.4 ± 0.7</b>
<b>Pooled data D paralysis</b>	<b>4.6 ± 0.5</b>	<b>4.0 ± 0.6</b>

**M moderate, D deep paralysis**

**Lenhardt et al. unpublished data 2023**



Procedure		Procedure developed by:	Approved by SOP committee	Approved by faculty:
<b>Robotic surgery</b>		Lenhardt/ Obal	Date	Date
Procedure time	3-6 hours			
General considerations	Less access to patient intraoperatively	quick turnovers wanted	Long cases	Good revenue for hospital
Procedures at UofL hospital:	Robotic assist proctectomy, cystectomy, hysterectomy, colon resection			
Preoperative considerations/ problems			Consequences	
Cardiovascular	H/O HTN, CHF, MI, Angina etc, Mitral valve pathology/ pulmonary artery hypertension		ECG, Stress test?, Echo?	
Pulmonary	H/O COPD, Asthma, restrictive lung disease		PV test, spirometry	
Neurology	H/O Stroke, TIA, PRIND, seizures, any disease accompanied by increased ICP, known peripheral nerve injuries?			
Renal	Renal dysfunction?		BUN/ CREA	
Pre-OP laboratory tests suggested:	LFT, Anticoagulation, x-blood			
Monitoring/ Materials	Standard ASA monitoring	2 large IV lines (≥ 18G)	Neuromuscular monitoring TOF	To allow quick assessment of muscle relaxation
	ECG monitoring (V5 position?)	Bladder temperature	A-line if indicated	DM, CV compromised, cancer surgery
	BIS monitoring	Warming blanket		
	OG tube			
Induction of anesthesia	Regular induction, RSI if severe reflux disease (fundoplication procedures)			
Critical points during the procedure	Padding of pressure points			
	CVS	MAP↑ (SVR↑), filling pressure (CVP↑, wedge ↑), CO↓		
	Pulmonary	Complicance (30-50% ↓)		PEEP ≥ 5 cmH2O
		FRC↓		1:1 ventilation, PCV, PRVC
		Peak airway pressure↑		
	Neurology	paCO2↑↑		
		Upward displacement of endotracheal tube after trendelenburg positioning		Recheck BLBS! Airway secured well?
		CBE↑, ICP↑		
	Abdomen/ Liver	Intraocular pressure↑		NO tape, goggles !
		Check padding of extremities after trendelenburg positioning		Foam
Pneumoperitoneum	Intraabdominal pressure ↑			
	RBF, HBF ↓		Adequate volume status, urine output (1 ml/kg/h)	
	CO embolism, sudden desaturation		FiO2 ↑↑	
Intraoperative management	Emergency from Anesthesia			
Restrict fluid replacement to < 1 liter crystalloids%	Normocarbida			
volatile/TIVA equally appropriate	TOF% > 0.9 give Sugammadex			
Keep normothermic	Recruitment manoeuvre in reverse trendelenburg position/ sitting position to avoid shoulder p.			
Infiltration of insertion points with local anesthetic by surgeon	Recheck facial edema			
Communication with surgeon – 15 min prior to the end of procedure to avoid long turnover time; Allow reversal of trendelenburg position at earliest time point	Close monitoring of respiratory function, Stridor?, adequate MV? (Can patient breath around ETT with deflated cuff?)			
Postoperative management	Subcutaneous emphysema ? Airway obstruction?		1 <sup>st</sup> hour: 5 min RR monitoring in PACU (postoperative bleeding?), monitor SO <sub>2</sub> and breathing pattern	



Thank you

