CANDIDATES FOR PERSONALIZED VENTILATION

High risk surgery: cardiac, thoracics, major vascular, major abdominal, surgery > 2 hours, laparoscopic, trendelenberg position High risk patients: ICU patients, comorbid pulmonary disease, obesity, advanced age, emergency surgery

STEP 1 - CALCULATE IDEAL BODY WEIGHT

Online: http://www.calculator.net/ideal-weight-calculator.html; iOS apps (QxCalculate, The Ventilator App)

STEP 2 - SET INITIAL VENTILATOR SETTINGS

Tidal volume (V_T) 6-8 mL/kg IBW, Respiratory rate 12-16, I:E ratio determined by patient's pulmonary physiology (1:2 should be the default for patients with normal pulmonary parenchyma, 1:3 or less for patients with obstructive lung disease), F_1O_2 40% to be later adjusted to maintain SpO2 > 94%, PEEP 8 (normal BMI) or 10 (elevated BMI), Mode of ventilation to provider preference

STEP 3 - INDUCE ANESTHESIA

F_iO₂ < 100% (100% if anticipated difficult BMV and/or intubation to prolong apnea time before desaturation); CPAP during preoxygenation if high risk for atelectasis (obesity, restrictive lungs)

STEP 4 - RECRUIT THE LUNGS

Perform recruitment maneuver and set PEEP to 20 immediately thereafter

Hemodynamically robust: manual recruitment up to 40 cmH₂O for 10-40 seconds (use peak pressures of 55-60 if BMI > 35)

Hemodynamically sensitive: cycling maneuver - maintain inspiratory pressure 10-15 depending on compliance; bring PEEP from baseline to 10 to 15 to 20 with 5 breaths at each stage CAUTION! Decreased preload and hypotension are complications of recruitment maneuvers. Ensure starting blood pressure is at or above baseline before proceeding. Consider a vasopressor bolus before initiating a recruitment maneuver.

STEP 5 - PERFORM PEEP DECREMENT TRIAL (PDT)

Ensure PEEP to 20 before proceeding \rightarrow Switch to pressure controlled ventilation with a 10 cmH₂O pressure change, ensure compliance can be monitored. If not available monitor tidal volume delivered while on pressure control \rightarrow In a stepwise fashion with each stage held for 4 breaths lower PEEP by increments of 2 cmH₂O; the optimal PEEP setting is achieved when compliance (or V_T) is maximal during a PEEP decrement trial \rightarrow set PEEP at or up to 2 points greater than the optimal PEEP level > 20 may be necessary. Commence PDT with initial PEEP set to 30 or higher.

STEP 6 - MONITOR SAFETY OF TIDAL VOLUME

Measure driving pressure (DP) and attempt to maintain under 13 to ensure safe transpulmonary strain

Switch to volume control ventilation (VCV) \rightarrow Set inspiratory hold at 40% of inspiratory phase \rightarrow plateau pressure (P_{plat}) measurement - PEEP level = DP \rightarrow reduce V_T or repeat a RM and PDT to attempt lowering DP to safe range

STEP 7 - MAINTENANCE OF OPEN LUNG VENTILATION

Perform a RM if derecruitment occurs (position change, following a circuit disconnect or suctionng, laparoscopy): 1) manual RM, 2) cycling maneuver, 3) sigh breaths (set V_T to double the baseline value for 6 breaths then return to baseline V_T)

STEP 8 - MAXIMIZE RECRUITMENT PRIOR TO EXTUBATION

Optimize pulmonary mechanics prior to extubation (especially in high risk patients): extubate from pressure support ventilation (PSV) in an upright or sitting position, set F_iO₂ to maintain S_pO₂ > 94% (avoid F_iO₂ > 0.8); optimize analgesia (narcotic sparing); transition to CPAP/BiPAP support post extubation in high risk patients