initial strategies for HAMILTON-TI

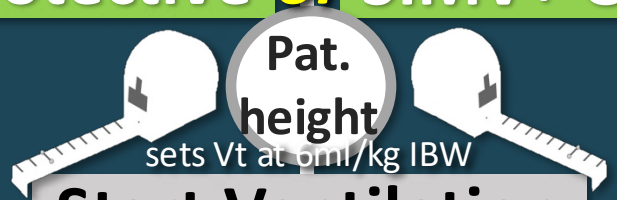
SIMV+
Pressure Regulated Volume Control

Adult/ped circuit if ≥4 year-old/15kg IBW

Adult/Ped.

Male or Female

SIMV+ Protective *or* SIMV+ Obstructive



Start Ventilation

Protective lung strategy (all other patients)

Rate

start rate at

age (years)	4	6	8	10	12	14	≥16
initial Rate	26	24	22	20	20	18	*16*

then titrate to normal CO_2/pH

PEEP/CPAP

use PEEP/O_2 scale

5	5	8	8	10	10	10	12	14	14	14	16	18	18	20
30	40	40	50	50	60	70	70	70	80	90	90	90	100	100

Oxygen

to titrate to SpO_2 of 92-95%

Controls

- I:E=1:2 TI
- 100ms P-ramp
- 25% ETS
- 30 cmH_2O Plimit (alarms at 40)

(re-titrate with every Rate change)

Obstructive lung strategy (asthma/COPD)

Rate

start rate at

age (years)	4	6	8	10	12	14	≥16
initial Rate	13	12	11	*10*	*10*	*10*	*10*

then titrate to fastest Rate on flow/time waveform that avoids breath-stacking. Permissive hyperCO_2 (pH>7.15)

PEEP/CPAP

5

Oxygen

titrate to SpO_2 of 86-92%

Controls

- I:E>1:4 TI
- 50ms P-ramp
- 40% ETS
- 40 cmH_2O Plimit (alarms at 50)

(re-titrate with every Rate change)

Stacy Turner 2021, George Douros 2024

SIMV+ troubleshooting for HAMILTON-TI

If **Pressure limitation** press **Alarms**; increase upper limit of Pressure (max 70) to allow VTE while troubleshooting

Ensure patient is sedated and ETT suctioned and patent.

- if high pressures resolved, return Pressure limit to normal levels
- If high pressures continue, touch the waveforms then **Graphics** then **Dynamic Lung**

R_{insp}<15
C_{stat}<<50 low Compliance

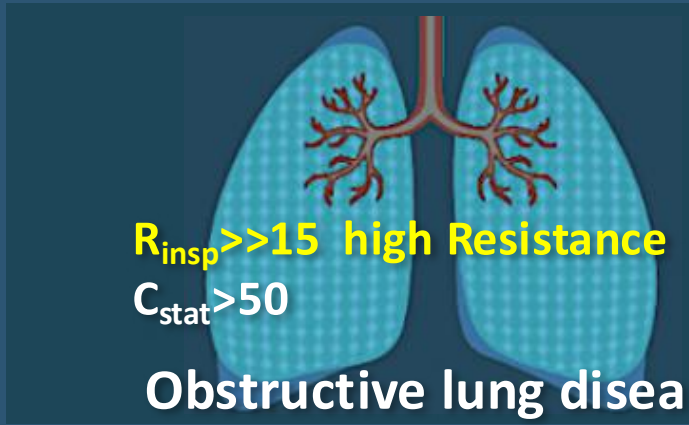
Restrictive lung disease

Seek & treat
-chest causes (pneumothorax)
-abdominal causes (distention)

Protective lung strategy ***PLUS***

- ↓**VTe** by 15% and
- ↑**Rate** by 20% to maintain MinVol

If ongoing issues; try ASV



R_{insp}>>15 high Resistance
C_{stat}>50

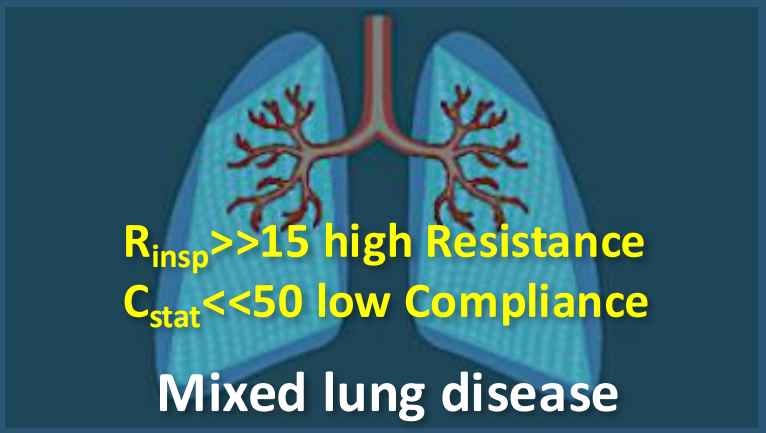
Obstructive lung disease

Seek & treat
-blocked/kinked/dislodged tube/ wet circuit
-bronchospasm

Obstructive lung strategy ***PLUS***

- ↓**Rate** so no breath-stacking visible on flow/time waveform (min 5)
- **I:E ratio** ≥ 1:4

If ongoing issues; try ASV



R_{insp}>>15 high Resistance
C_{stat}<<50 low Compliance

Mixed lung disease

Obstructive lung disease plus *EITHER*
-gas trapping *OR*
-Restrictive lung disease

If gas trapping, follow high Resistance trouble shooting. If BP drops, disconnect patient & manually decompress chest.

If mixed lung disease; try ASV

Stacy Turner 2021, George Douros 2024

rescue strategy for HAMILTON-TI

ASV
Adaptive Support Ventilation

Closed circuit ventilation; contraindicated in uncuffed tubes/ bronchopleural fistulas

Modes

ASV

Adult/ped circuit if ≥4 year-old/15kg IBW

sex & height set MV at 100ml/kg IBW (more for kids)

confirm

Protective lung strategy

%MinVol

110% for normal lungs (10% for dead space)
130% for febrile/ARDS/pregnancy
150% for metabolic acidosis (max:300%)
-titrate by 10% steps to desired CO_2/pH

use PEEP/O_2 scale

5	5	8	8	10	10	10	12	14	14	14	16	18	18	20
30	40	40	50	50	60	70	70	70	80	90	90	90	100	100

PEEP/ CPAP

to titrate SpO_2 of 92-94%

Oxygen

Obstructive lung strategy

90% for asthma/COPD
titrate by 10% steps to desired CO_2/pH
(permissive hypercapnoea, pH>7.15
∴ sedate +++)

5

titrate to SpO_2 of 88-92%

Controls

Protective	Obstructive
30cmH$_2$O Plimit (alarms at 40)	40cmH$_2$O **Plimit** (*alarms at 50*)
100ms P-ramp	50ms **P-ramp**
25% ETS	40% **ETS**

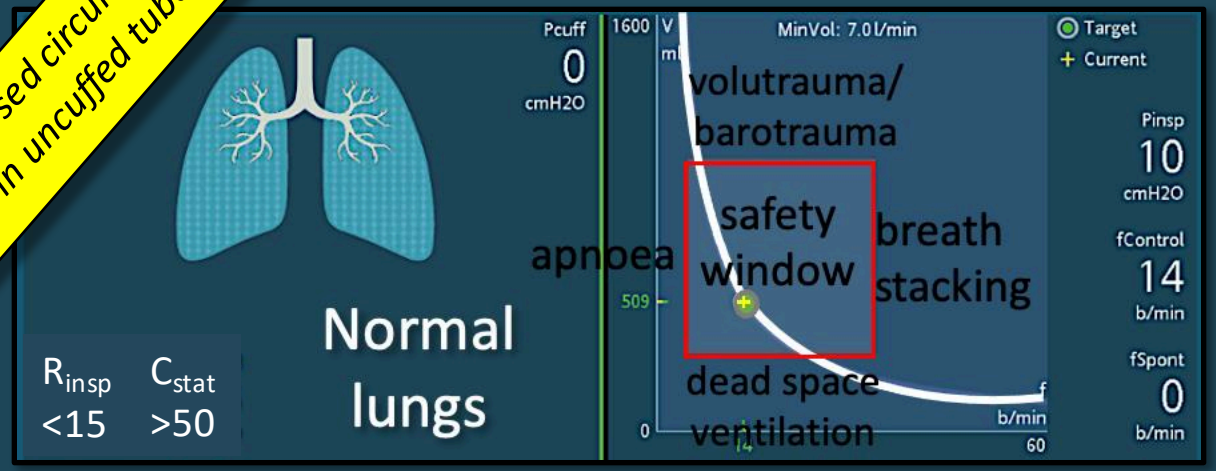
Stacy Turner 2021, George Douros 2024

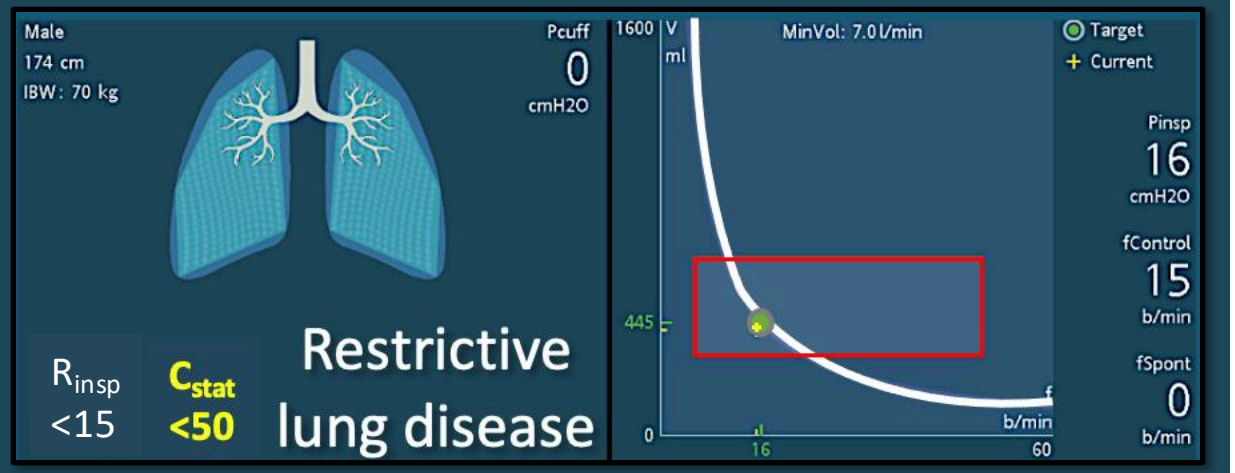
ASV
Adaptive Support Ventilation

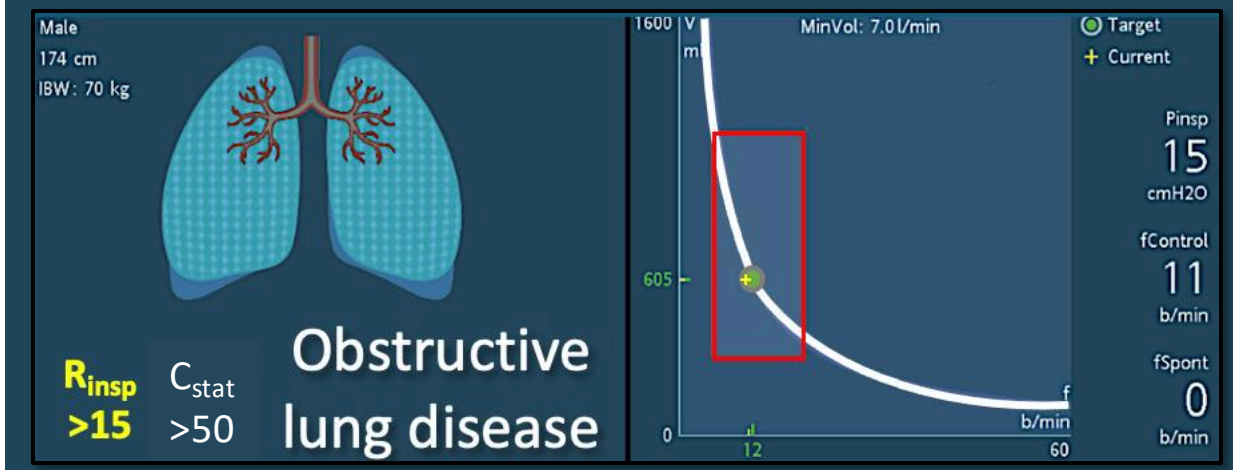
Closed circuit ventilation; contraindicated in uncuffed tubes/ bronchopleural fistulas

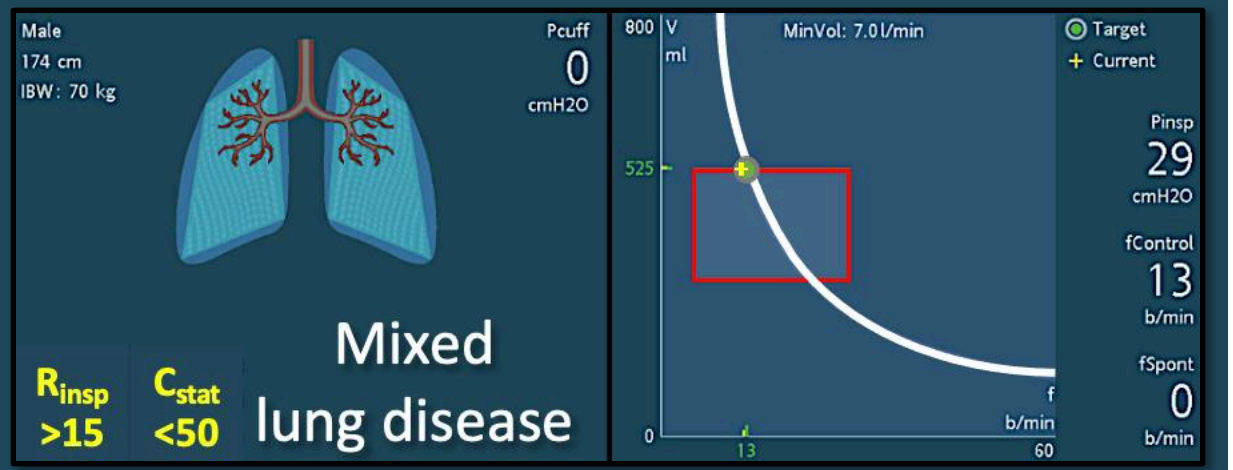
Dynamic Lung and ASV Graph

To understand what ASV is doing, tap the waveform graphs, then **Graphics** then **Dynamic Lung** to understand physiology and **ASV Graph** to understand ventilation strategy. Troubleshoot the patient as per SIMV+ card and titrate ventilator as per this card.









Stacy Turner 2021, George Douros 2024

NIV strategies for HAMILTON-T1

NIV

Apnea backup mode: PCV+
rate: 12 bpm

Adult/Ped.

Adult/ped circuit if
≥4 year-old/15kg IBW

NIV

Start Ventilation

Protective lung strategy
(type-1 respiratory failure)

Obstructive lung strategy
(type-2 respiratory failure)

PEEP/CPAP

titrate using PEEP/O_2 scale

5	5	8	8	10	10	10	12	14	14	14	16	18	18	20
30	40	40	50	50	60	70	70	70	80	90	90	90	100	100

5

Oxygen

to SpO_2 of 92-95%

titrate to SpO_2 of 86-92%

ΔPsupport

Start at 5 and titrate ΔPsupport
to ensure enough VTe (range 6-10/Kg IBW)
to get patient's respiratory Rate <25 bpm

Further titration to desired CO_2/pH.

	5'0" 153cm	5'2" 156cm	5'4" 163cm	5'6" 168cm	5'8" 173cm	5'10" 178cm	6'0" 183cm	6'2" 188cm	6'4" 193cm
6ml/kg ♀	276	296	330	360	385	415	440	470	490
8ml/kg ♀	364	401	438	474	511	548	485	622	658
10ml/kg ♀	455	500	546	592	638	685	730	777	822
6ml/kg ♂	305	320	360	385	415	440	470	490	520
8ml/kg ♂	400	437	474	510	547	584	621	658	694
10ml/kg ♂	500	546	592	638	685	730	777	822	868

30cmH$_2$O Plimit (alarm at 40)

100ms P-ramp

35% ETS

Controls

More

30cmH$_2$O Plimit (alarm at 40)

50ms P-ramp

40% ETS

Stacy Turner 2021, George Douros 2024

NIV

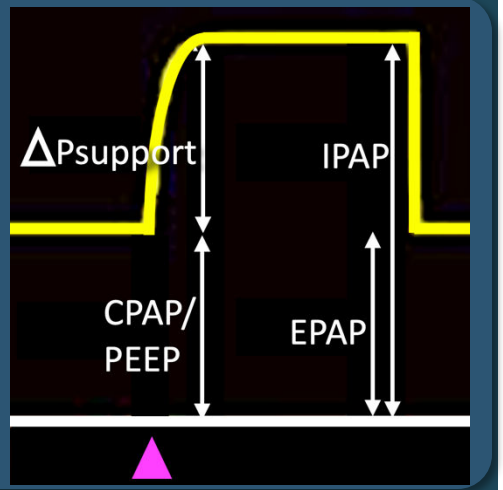
Apnea backup mode: PCV+

Troubleshooting for HAMILTON-TI

If VT low and Ppeak low, press Monitoring 2. If **Vleak > 10%**, adjust/change mask

Patients on home ventilators (including Obstructive Sleep Apnoea):

- Check the medical record for their home ventilator pressures, noting →
- PEEP/CPAP for OSA splints the upper airway open as opposed to the alveoli, thus pressures are much higher. If home CPAP machine pressure is unknown, start PEEP/CPAP at **(Actual-Body-Weight in kg)/10** and titrate to pressure required for absence of obstruction/snoring.



Ventilator Assisted PreOXygenation (VAPOX):

- Oxygen = 100%.
- PEEP/CPAP as per protective or obstructive lung strategy unless OSA in which case (Actual-Body-Weight in kg)/10
- Controls Apnea Rate = 6 bpm so that it is obvious when induction drugs have worked.

Stacy Turner 2021, George Douros 2024