A REVIEW OF VDR USE

Objectives

- Identify the parts of the VDR 4 and circuitry
- Explain the set parameters and appropriate initial settings
- Describe adjustments based on arterial blood gas results

VDR Applications

Secretion Management

Adult ARDS, Pneumonia, Influenza.

Pertussis, RSV, Bronchiopulmonary Dyplasia history

Rescue, Near Drowning

Status Asthmaticus

Burn Patients

Any patient with a P/F ratio less than 100 or Oxygen index greater than 25

Failing Conventional Ventilation

Peak Inspiratory Pressures <35-40

Nano Preemie guidelines- Following Legacy and Iowa successes

Parameters

- Pulsatile flow similar to PIP
- CPAP/PEEP
- Convective pressure rise (3rd pressure)
- I:E
- Percussive rate
- Convective rate
- The "Vt" is the pressure difference between the Pulsatile flow and the PEEP (delta P =△ P)
- If you increase the △P, the "Vt" increases and the CO2 decreases
- If you decrease the △P, the "Vt" decreases and the CO2 increases

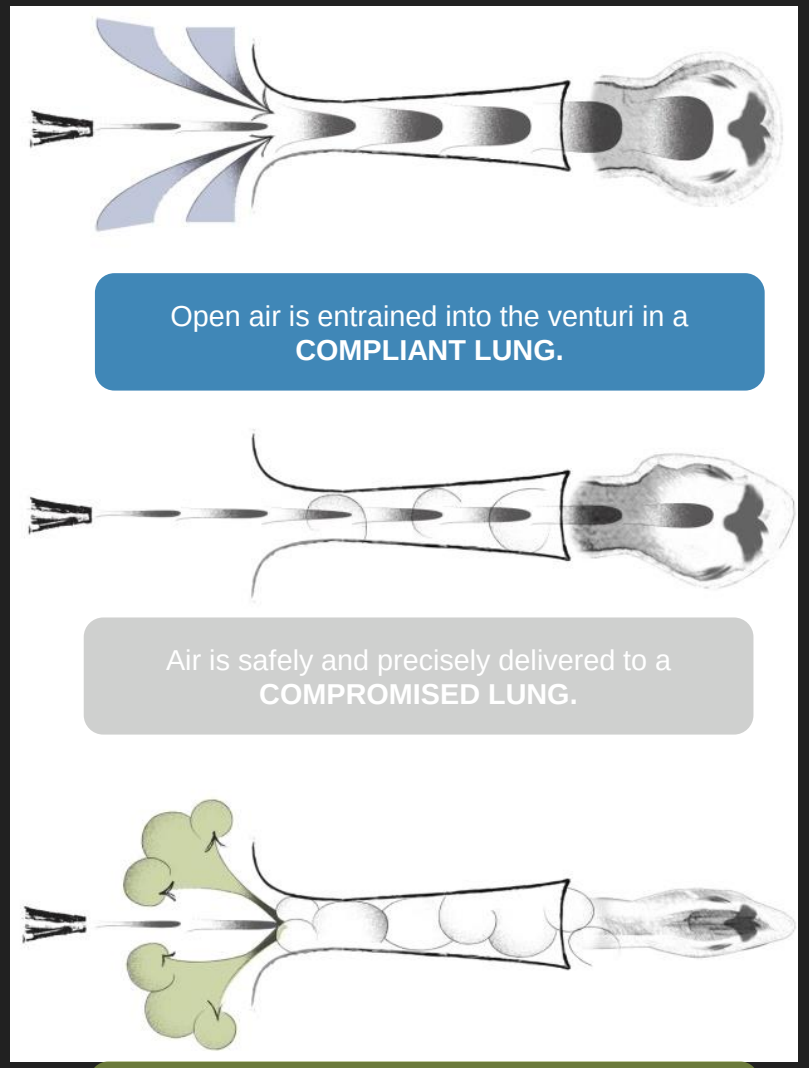
SELECTED
OPERATING
PRESSURE
PROXIMAL AIRWAY
PRESSURE
AIR-OXYGEN BLENDER
35-40 P.S.I NORMAL
DECREASE
INCREASE
INTEGRATED
MANOMETER
MAXIMUM OPERATIONAL PRESSURE RISE LIMITED
BY INSTITUTIONAL DEMAND FLOW/PRESSURE

SERVOLATOR
PERCUSSIONATOR
CONVECTIVE PRES. RISE
PULSATILE FLOWRATE
INSPIRATORY TIME
I/E
EXPIRATORY TIME
OSCILLATORY CPAP/PEEP
DEMAND CPAP/PEEP
FAILSAFE SENSITIVITY
MASTER
NEBULIZATION
PULSE FREQUENCY
PULSE I/E RATIO
MANUAL INSP
RESET ALERT
VDR
MODEL VDR-4

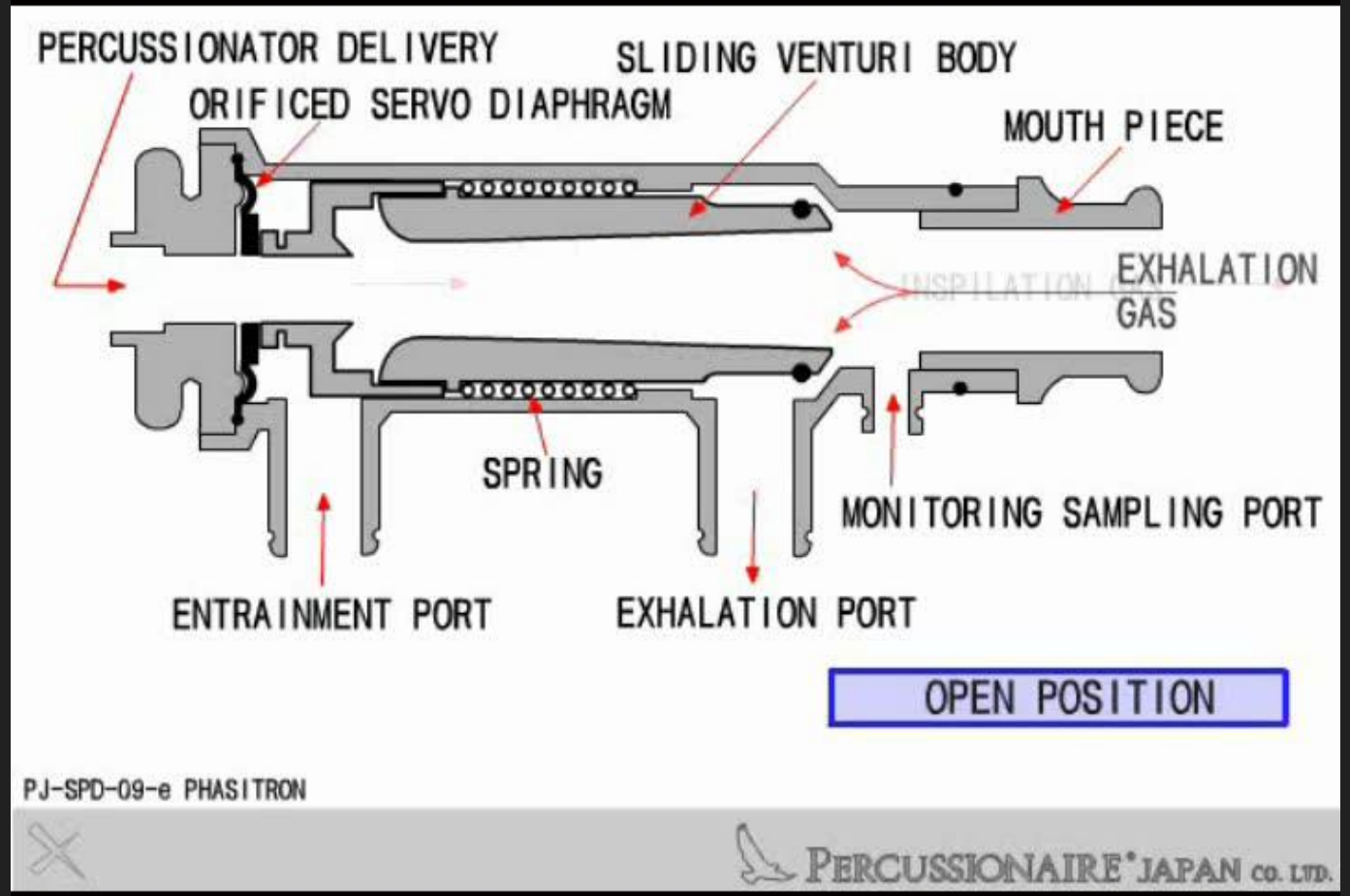
Initial Settings

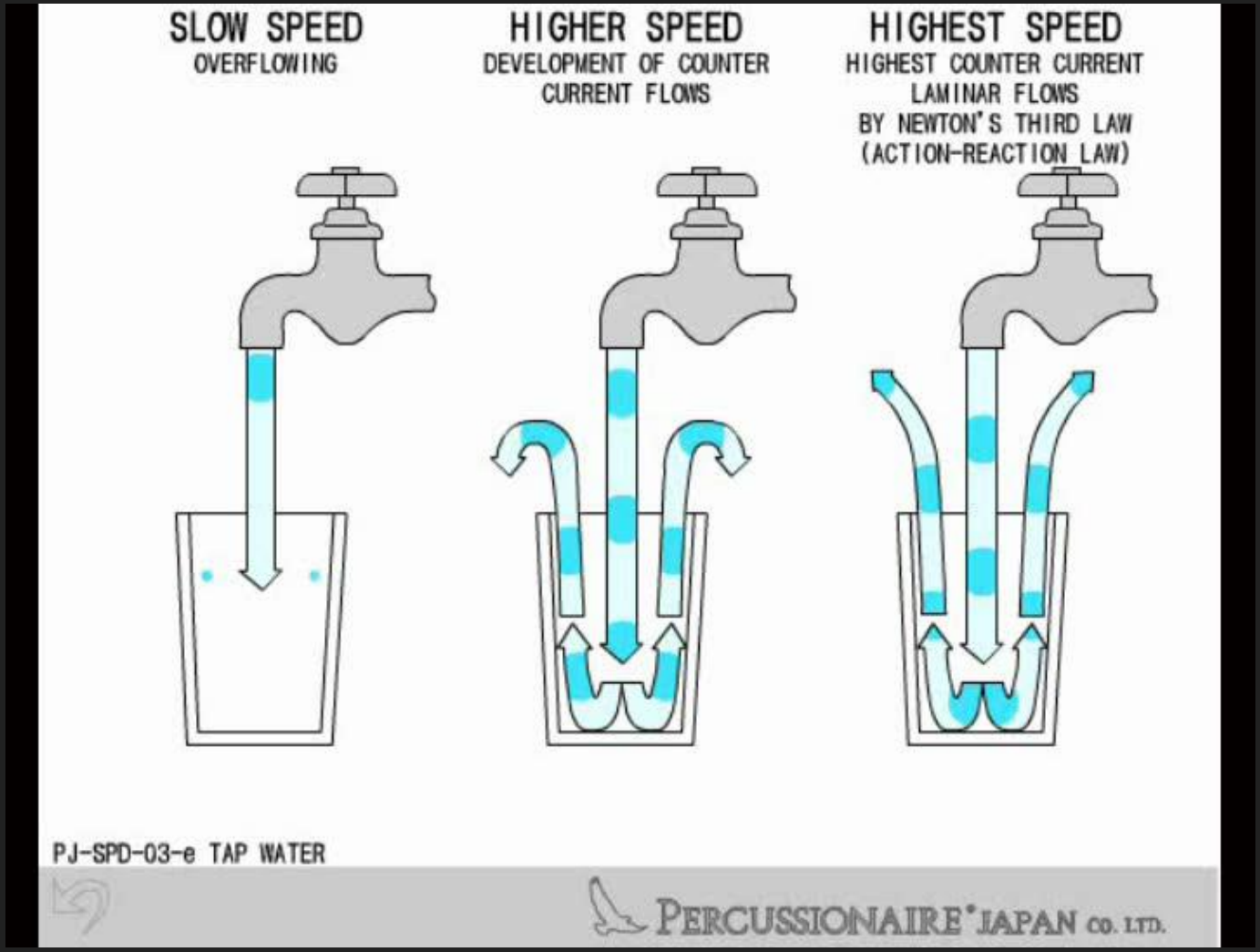
Control	Adult	Pediatric	Neonate
Operating pressure (psi)	40	40	40
Pulsatile Flowrate PIP (cmH2O)	20-30	20-30	2 above conventional
Convective Rate (bpm)	15	30	30
Inspiratory/Expiratory time (sec.)	2/2	1/1	1/1
Oscillatory PEEP (cmH2O)	5-10	5-10	5
REMEMBER: If Demand PEEP/CPAP is on, it combines the total PEEP with Oscillatory PEEP. For example: Oscillatory PEEP 5cm + Demand PEEP/CPAP 5cm = total set PEEP of 10cm			
Demand PEEP/CPAP (cmH2O)	0	0-5	0
Pulse Frequency Rate (cycles)	500	500	700-800
FiO2 (%)	Previous setting	Previous setting	Previous Setting
Heater temp. with the distal circuit can be turned down. I would leave it at 40 with the original circuit.			
NICU vents should be tested with nicu lungs, all adult VDR's should use the percussionaire test lungs.			

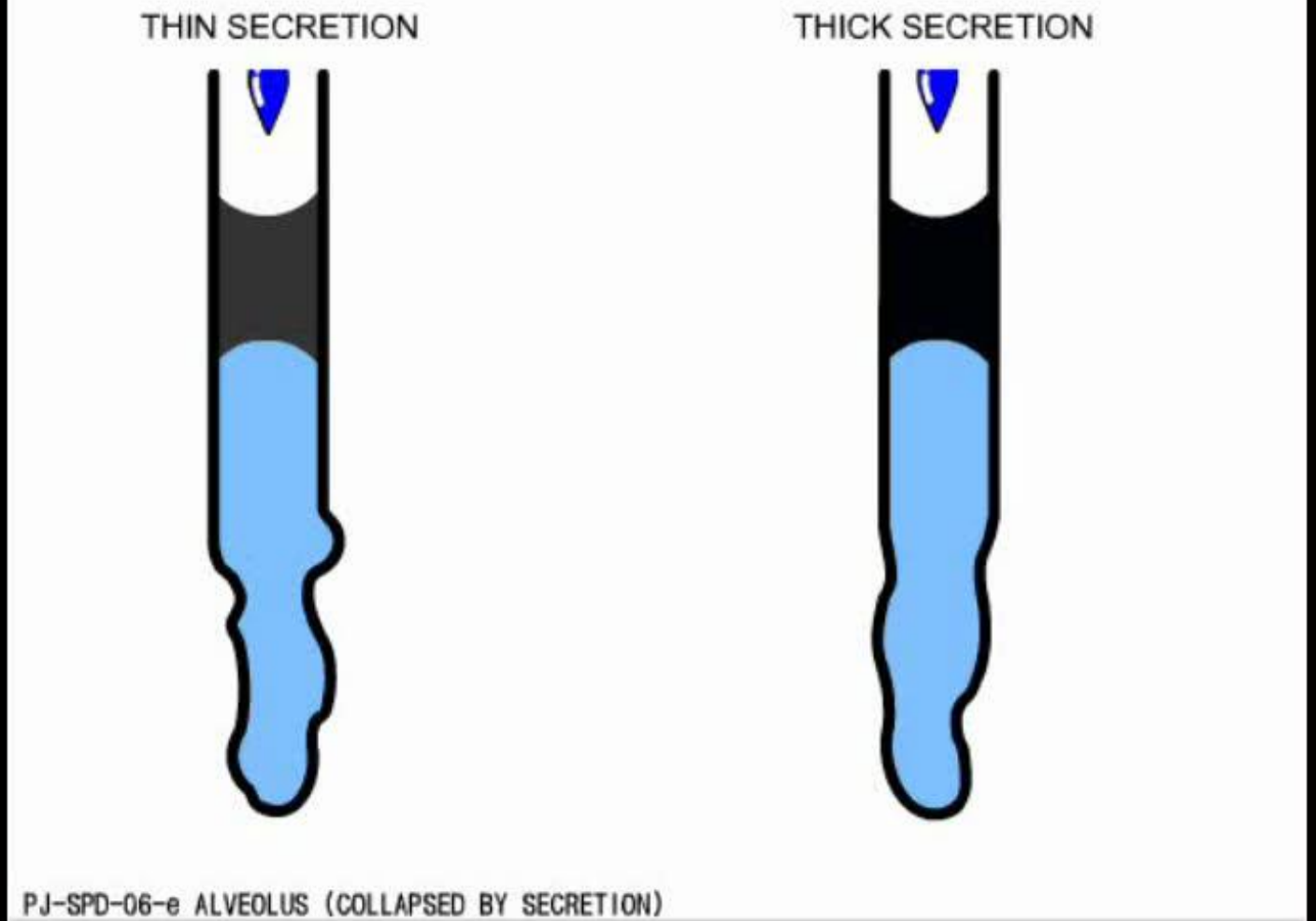
The Elegant Solution



- Venturi safety “clutch” mechanism
  - Automatic adjustment
    - Responds directly to the patient
      - Adjusts to lung volume
      - Adapts to compliance
    - Physiological calculation
      - Simplifies controls
      - Protects from over pressure.


PERCUSSIONATOR DELIVERY
SLIDING VENTURI BODY
ORIFICED SERVO DIAPHRAGM
MOUTH PIECE
EXHALATION GAS
SPRING
MONITORING SAMPLING PORT
ENTRAINMENT PORT
EXHALATION PORT
OPEN POSITION
PJ-SPD-09-e PHASITRON
PERCUSSIONAIRE JAPAN CO. LTD.

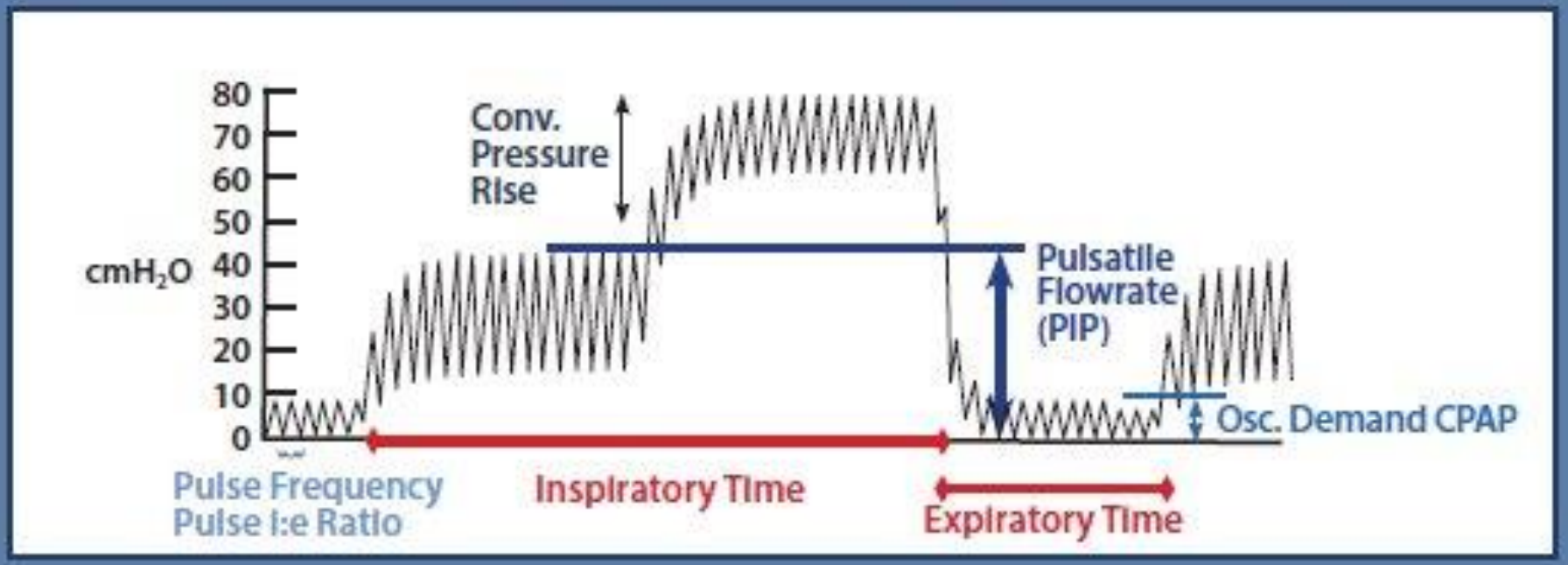

SLOW SPEED
OVERFLOWING
HIGHER SPEED
DEVELOPMENT OF COUNTER CURRENT FLOWS
HIGHEST SPEED
HIGHEST COUNTER CURRENT LAMINAR FLOWS BY NEWTON'S THIRD LAW (ACTION-REACTION LAW)
PJ-SPD-03-e TAP WATER
PERCUSSIONAIRE JAPAN CO. LTD.



PJ-SPD-06-e ALVEOLUS (COLLAPSED BY SECRETION)

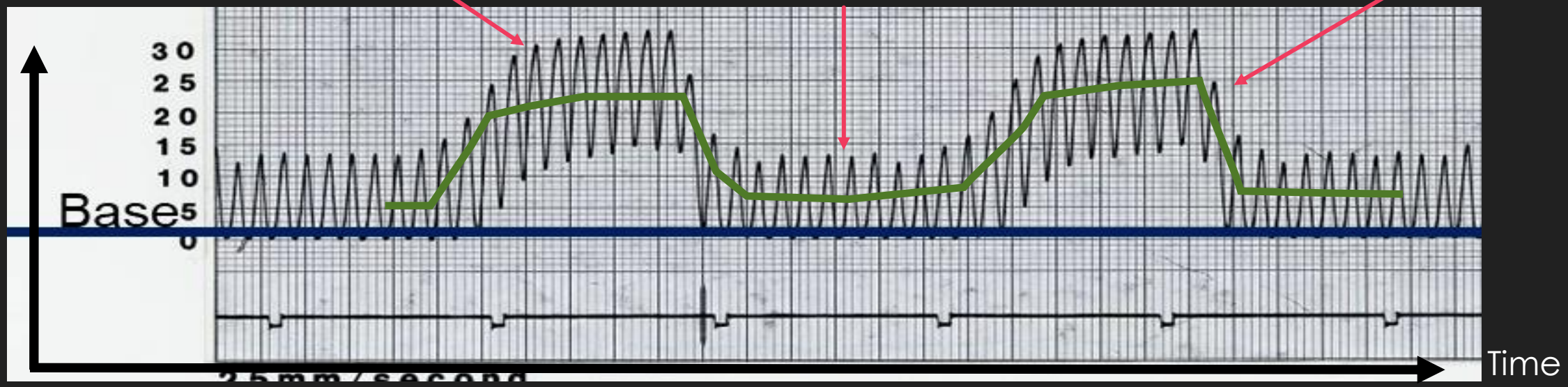
PERCUSSIONAIRE JAPAN CO. LTD.

ANATOMY OF THE VDR®-4 WAVEFORM



VDR Bi-Phasic Amplitudinal Waveform

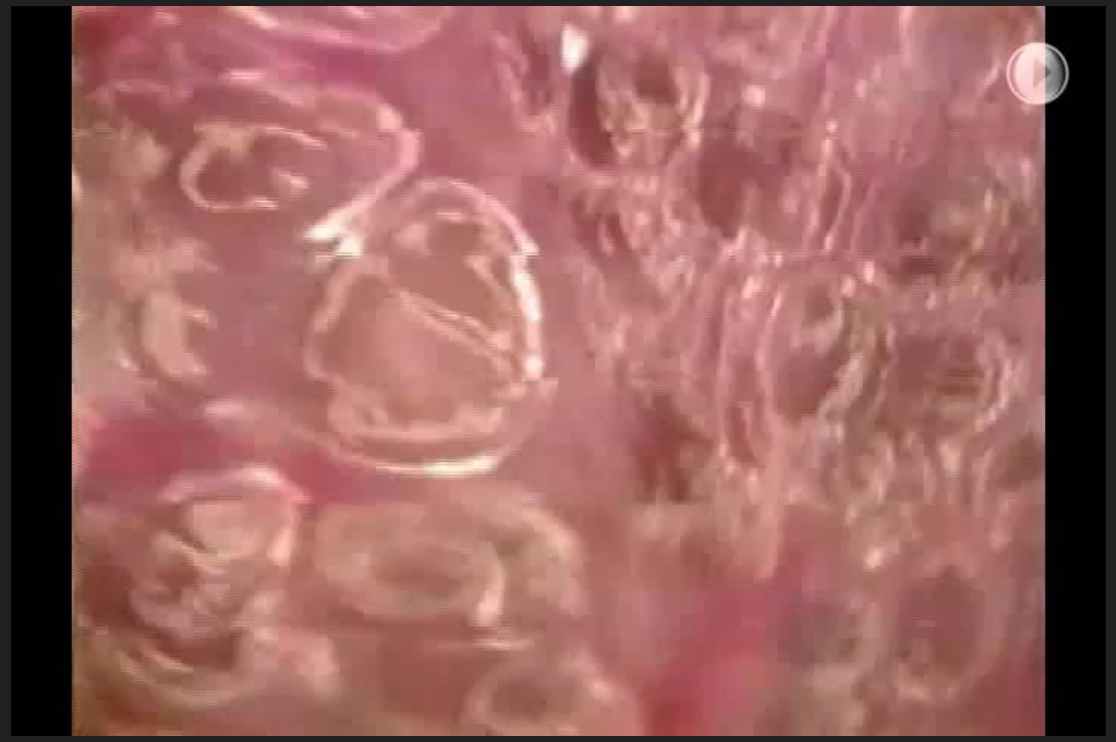
Bi-Phasic MAP



Pulsatile flow - **Inspiratory amplitude**
Demand/Oscillatory CPAP - **Expiratory amplitude**
High frequency pulses happen throughout whole cycle of ventilation **(measured each minute)**
MAP is generated from the data **throughout** the waveform
The manometer on the top of the VDR will read the most accurate pressures.

Alveolar Ventilation

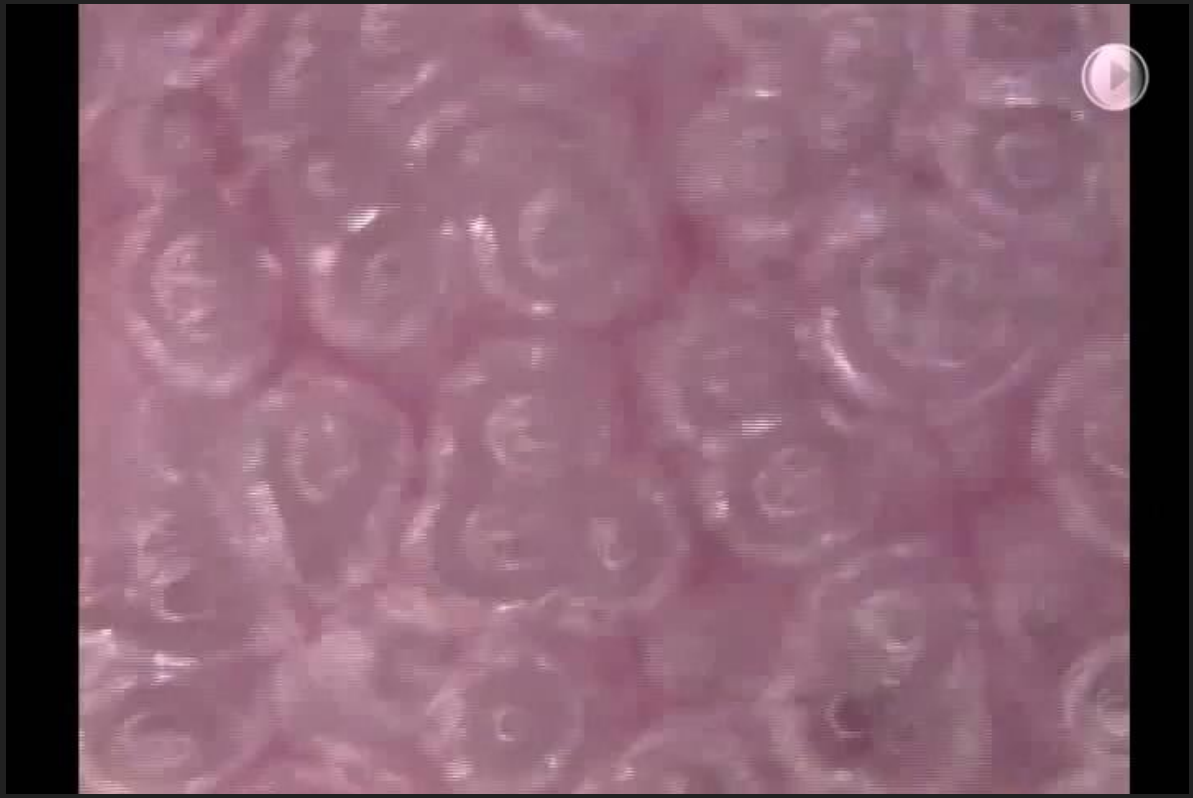
Schiller et al. *Crit Care Med*. 2001;29:1049



Normal Lung

ARDS Lung

VDR Ventilation®
PIP 24 PEEP 12 (▲P = 12)



VDR Adjustments

Decreased pH/ Increased CO2 (Acidosis)

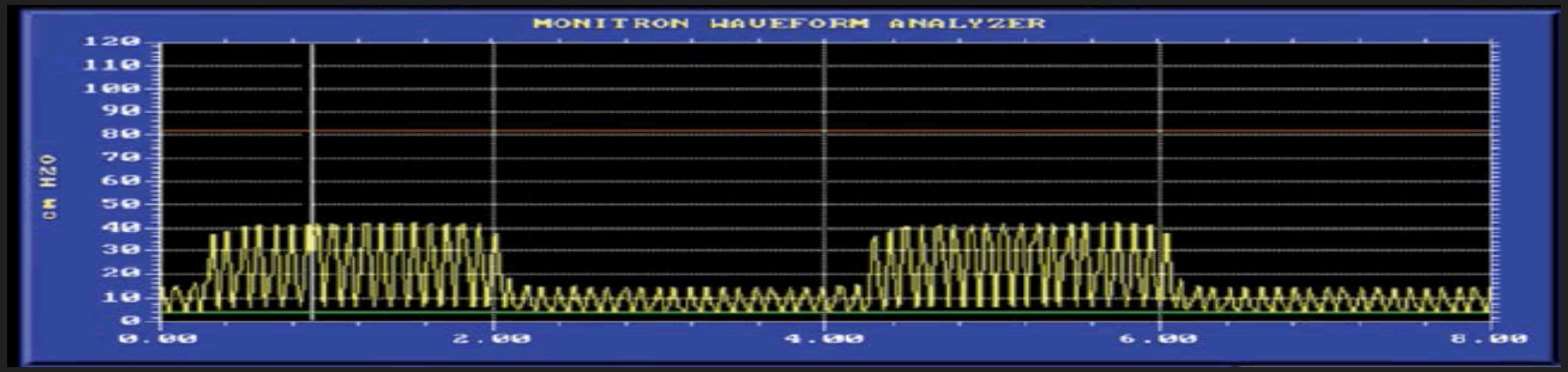
- Increase PIP (pulsatile flow)
- Decrease CPAP/PEEP
  - These both increase the ΔP
- Decrease pulse frequency
- Small cuff leak (last choice)

Increased pH/ Decreased CO2 (Alkalosis)

- Decrease Pulsatile flow (PIP)
- Increase CPAP/PEEP
  - These both decrease the ΔP
- Increase pulse frequency

Oxygenation

- Increase FiO2
- Increase CPAP/PEEP
- Increase Pulsatile Flow (PIP)
- Add convective pressure rise (for recruitment-last choice)



Patient One:

VDR

- Pulsatile Flow: 26
- Oscillatory CPAP: 12
- Pulse Frequency: 500
- Convective Rate: 15
- I/E: 2/2
- Oxygen: 100%
- Convective Pressure Rise: Off

ABG

- pH: 7.07
- $PaCO_2$:75
- PaO_2: 146
- HCO_3: 16

Patient Two:

VDR

- Pulsatile Flow: 24
- Oscillatory CPAP: 10
- Pulse Frequency: 500
- Convective Rate: 15
- I/E: 2/2
- Oxygen: 80%
- Convective Pressure Rise: Off

ABG

- pH: 7.34
- $PaCO_2$:53
- PaO_2: 58
- HCO_3: 26

Patient Three:

VDR

- Pulsatile Flow: 22
- Oscillatory CPAP: 8
- Pulse Frequency: 500
- Convective Rate: 15
- I/E: 2/2
- Oxygen: 100%
- Convective Pressure Rise: Off

ABG

- pH: 7.11
- $PaCO_2$:63
- PaO_2: 63
- HCO_3: 22

Patient Four:

VDR

- Pulsatile Flow: 24
- Oscillatory CPAP: 10
- Pulse Frequency: 500
- Convective Rate: 15
- I/E: 2/2
- Oxygen: 100%
- Convective Pressure Rise: Off

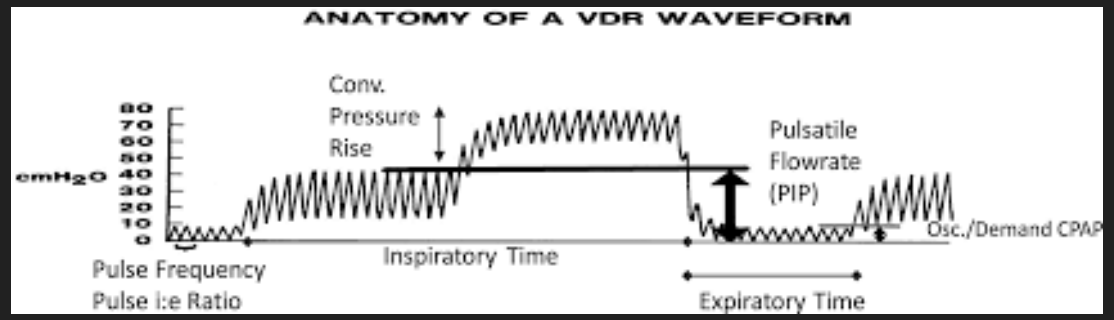
ABG

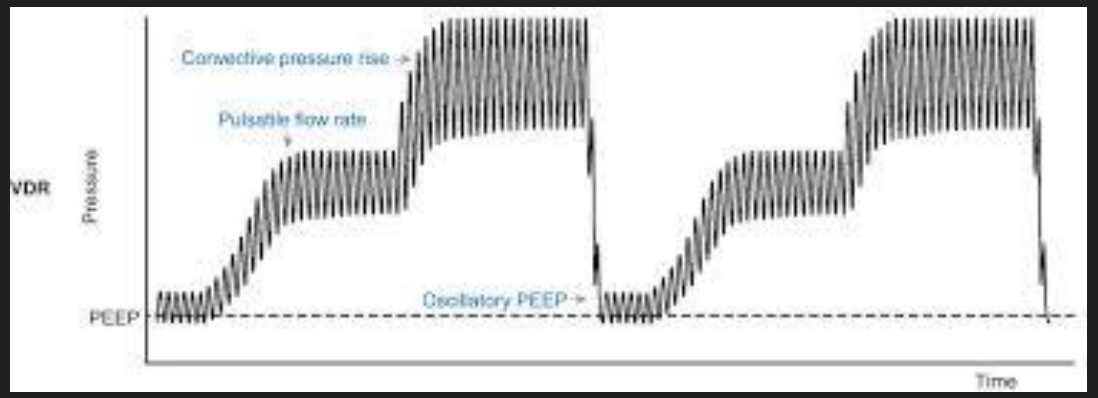
- pH: 7.50
- $PaCO_2$:25
- PaO_2: 51
- HCO_3: 25

What are the advanced maneuvers for recruitment after adjusting Oscillatory CPAP/PEEP

- Increasing I time in .5 second increments up to a high of 3.5 seconds?????
- Adding convective pressure rise
- Increasing high frequency rate by 50-100 breaths up to 700. (preferable increase =100 breaths)

I time	E time	Conv. Rate	Total I Time
2.0	2.0	15	30 secs.
2.5	1.5	15	37 secs.
3.0	1.0	15	45 secs.
3.5	1.5	12	42 secs.





Adding a Convective Pressure Rise

- The two pressures are Pulsatile flow and CPAP. A third pressure, called convective pressure rise. Convective pressure helps recruit the lung. This is not done on a routine basis. It's only done when other setting changes are not working. Note: the gradient should be a minimum of 8. For example: If you're starting at 35/10 we will decrease the pulsatile flow to 32 and then add an 8 of Convective pressure rise. We will now be at a total of 40/10

I:E=1:1

Operating pressure of 40

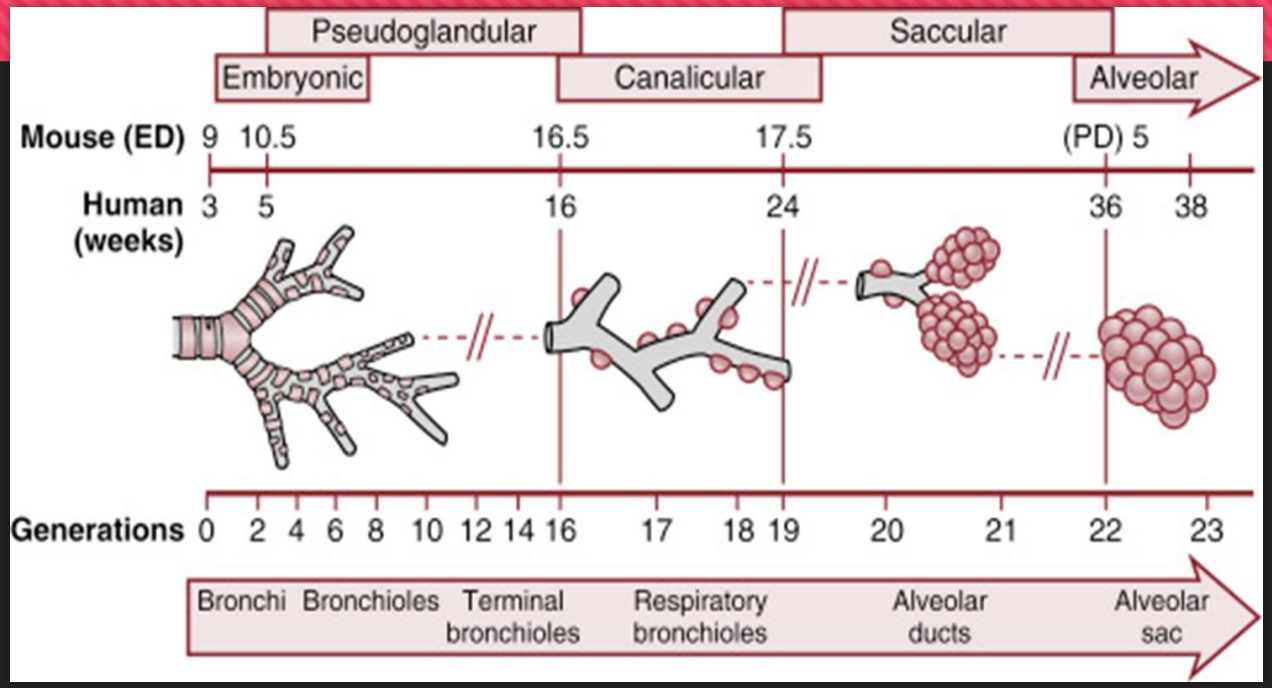
- Rate 30
- PIP is set 2 above conventional
- Usually equates to 18/5-6 which is decreased quickly post blood gases
- Looking for a Delta P of 5-6

- Special instance:
  - If we are maxed out with our pulse frequency turn the pulse frequency i/e to 9 o'clock. If you still cannot get 800 then turn the Operating pressure down in increments of 2. An operating pressure of 30 should be our minimum.

Neonatal

Initial settings Uber/Nano preemie 22 weeks

- Pulsatile flow around 12
- Peep 6-8
- Convective rate 20
- Frequency 700



Information to Share with the Nurse

- The VDR is a flow ventilator – turning or repositioning the patient may change the ventilator settings. Make sure your RT is in the room when you move the patient.
- The only setting the RN can change is the FiO_2. Always let the RT know of the change.
- The ETT needs to be clamped when taking the patient off the VDR. (Changing the red line, bagging, changing to a conventional ventilator) This avoids lung de-recruitment.
- Read the pressures (PIP and PEEP) off the manometer on top of the VDR.
- The FiO_2 knob is located on top of the ventilator (gray knob)
- This ventilator is very drying to the lungs. There are 2 sources of humidity, and the temperature is set at 40 instead of 37. This increase in temperature will help increase the humidity going to the lungs and help prevent secretion retention. We are looking at a new circuit in which the phasitron will be at the heater.
- Keep in mind spontaneously breathing patients will make the numbers look inaccurate.
- The RT will make small increment changes based on ABG results. ABG's will be drawn frequently until the patient has stable blood gases.

Resources

https://percussionaire.com/resources

Asante Rogue Regional Medical Center

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