Positive Pressure Ventilation In RDS

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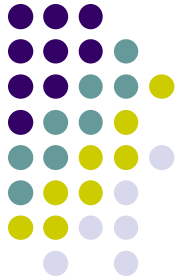
Mechanical or Invasive Ventilation

- **Movement of Gas into and out of lung**
  by external source (bag, respirator) connected directly to the patient
  (mask, ETT, NP, tracheostomy)

Mechanical or Invasive Ventilation



- **Despite best intentions to maximize non-invasive support**
  - many small infants will initially require MV
  - half of those less than 28 weeks'

- **Goal:**
  - Inflate atelectatic lung
  - Optimizing lung volume
    - prevent atelectasis (repeatedly atelectatic during expiration)
    - over-distension (increases risk of air leaks , PTX, PIE)

TABLE 23-3 Possible Indications for Intubation and Mechanical Ventilation in Neonates

Indication	Comment
Infant of <26 weeks' gestation	Consider for prophylactic surfactant therapy (NB: recent evidence no longer supports this)
Absent/poor respiratory effort	Inadequate/sporadic effort, poor air entry
Apnea/bradycardia	Refractory; recurrent; requiring PPV
Hypoxemia	$FiO_2 > 0.4$-0.6 to maintain targeted PaO_2/SpO_2
Hypercarbia	$PaCO_2 > 60$-65 mm Hg with pH < 7.20
Severe distress	Marked retractions on noninvasive support
Suspected airway obstruction	Severe micrognathia, oropharyngeal mass, other
Cardiovascular collapse	Heart rate <60 or shock; CPR
Congenital malformations	Diaphragmatic hernia, choanal atresia, other

PPV, Positive pressure ventilation; *FiO_2*, fraction of inspired oxygen; *PaO_2*, partial pressure arterial oxygen; *SpO_2*, oxygen saturation; *$PaCO_2$*, partial pressure arterial carbon dioxide; *CPR*, cardiopulmonary resuscitation.

Classification (the Basic Questions)

A. Trigger mechanism

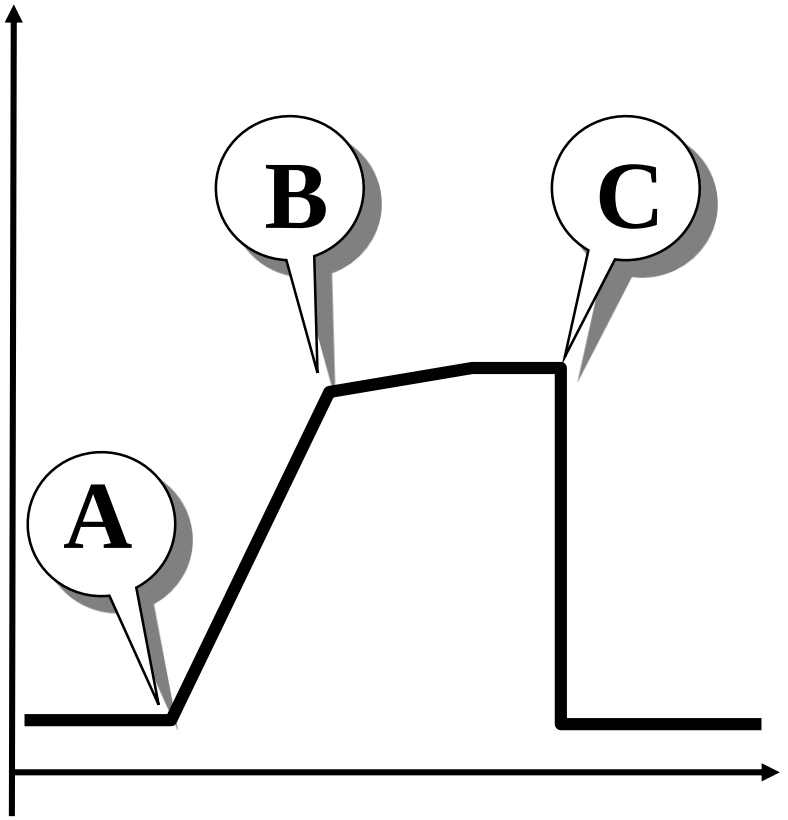
- What causes the breath to begin?

B. Limit variable

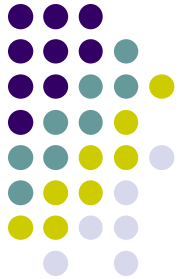
- What regulates gas flow during the breath?

C. Cycle mechanism

- What causes the breath to end?

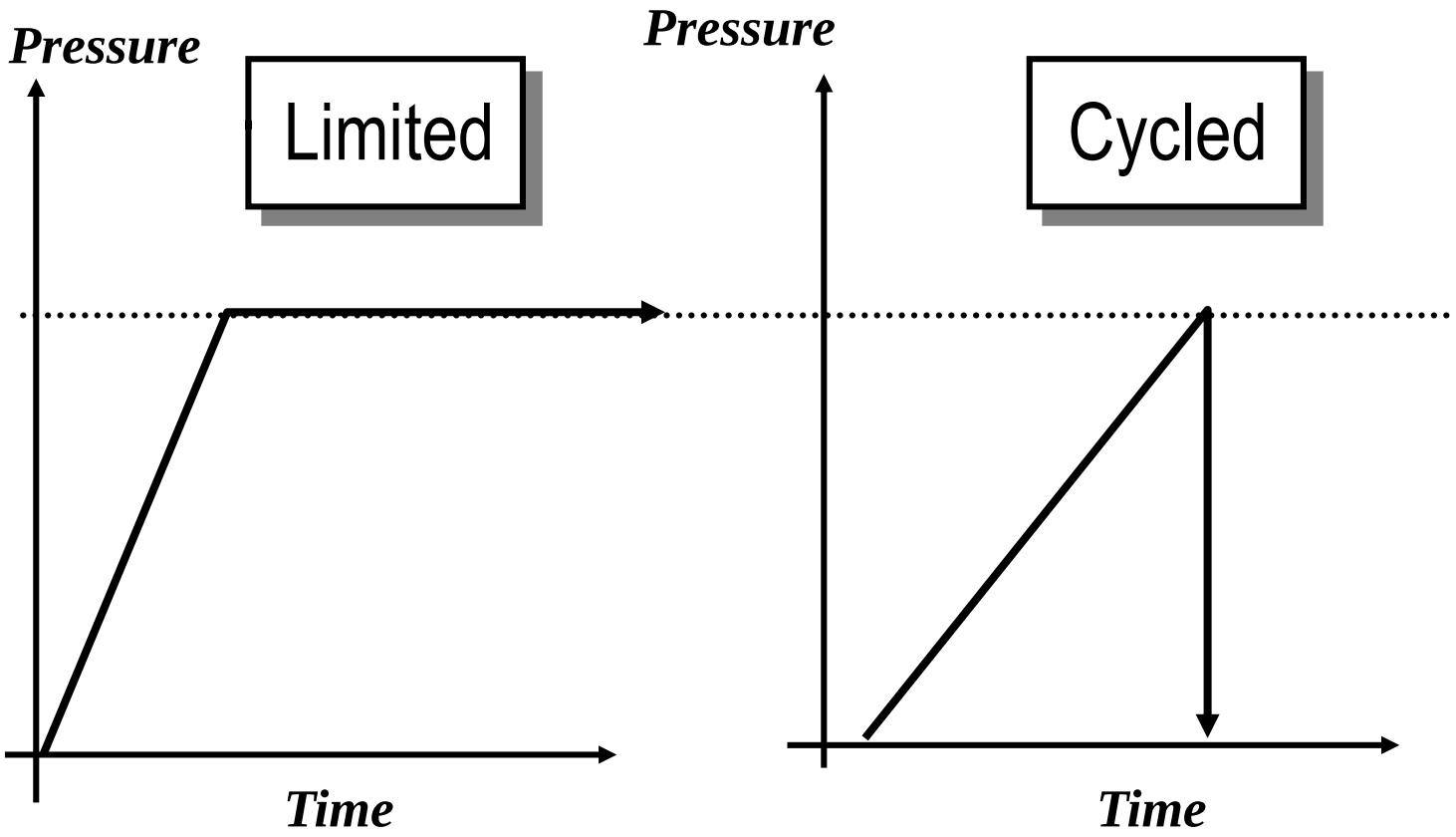


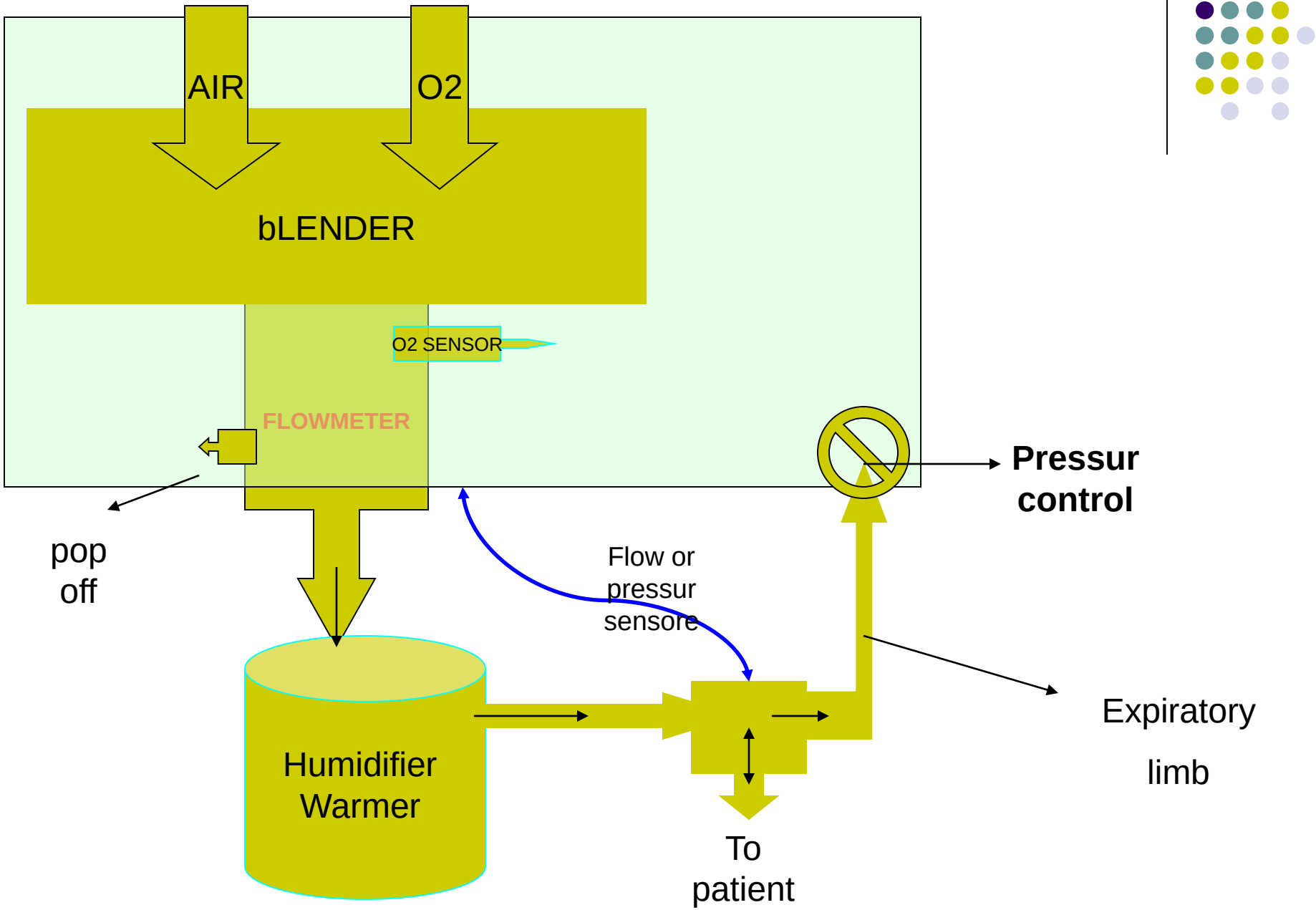
Inspiratory Trigger Mechanism



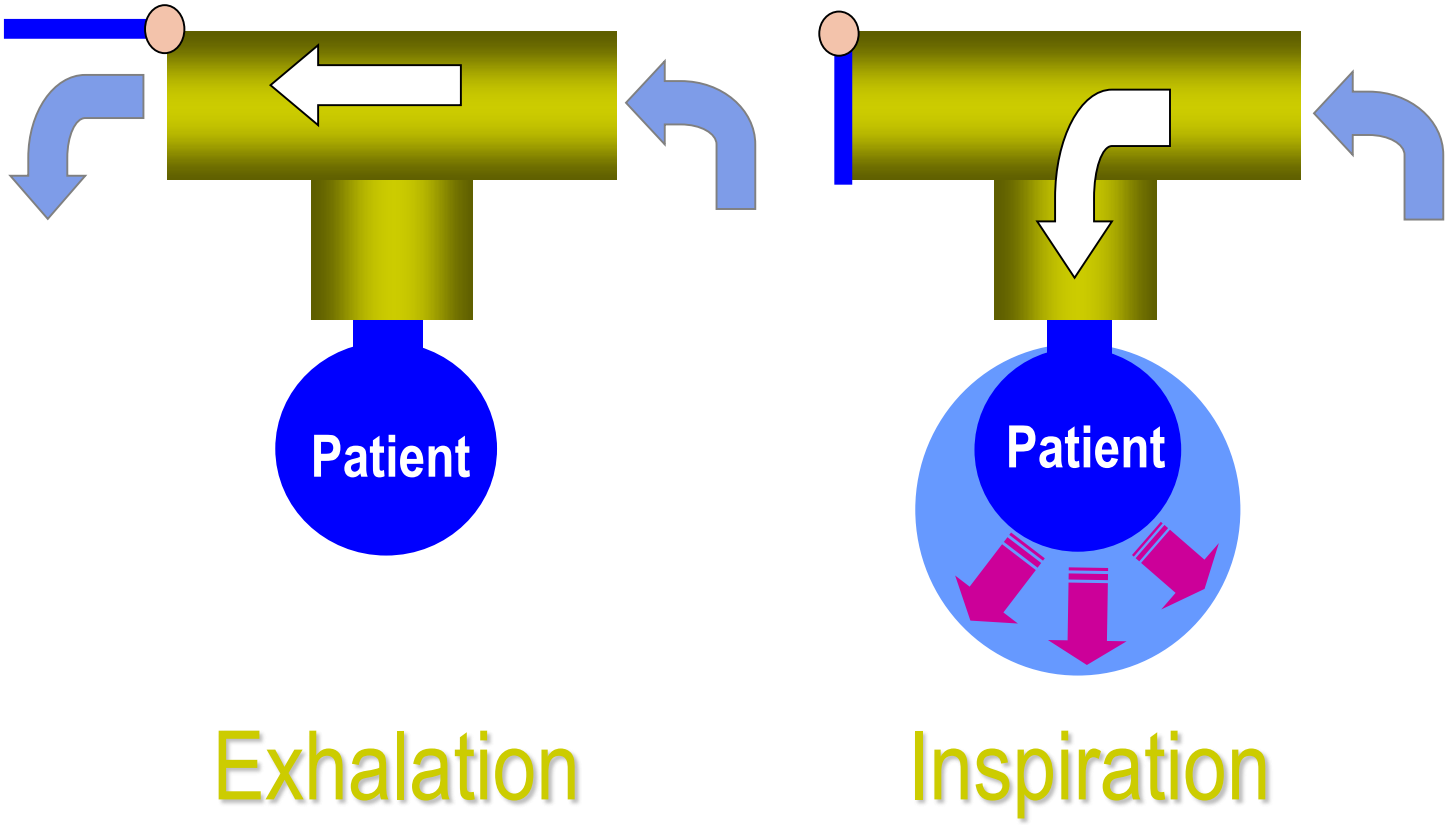
- **Time**
  - Controlled Mechanical Ventilation
- **Pressure**
- **Flow**
- **Chest impedance**
- **Abdominal movement**

Cycling Vs. Limiting




AIR
O2
bLENDER
O2 SENSOR
FLOWMETER
pop
off
Pressur
control
Flow or
pressur
sensore
Humidifier
Warmer
To
patient
Expiratory
limb

Intermittent Mandatory Ventilation

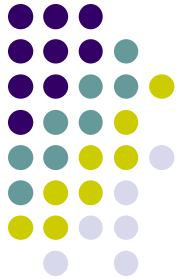


Ideal Mode of Ventilation

Delivers a breath that:

- Synchronizes with the patient's spontaneous respiratory effort
- Maintains adequate and consistent tidal volume and minute ventilation at low airway pressures
- Responds to rapid changes in pulmonary mechanics or patient demand
- Provides the lowest possible WOB

II.Ventilator classification….



1. Out put(volume or pressure or both)
2. Trigger(pressure, volume, flow)
3. Cycling(time, flow, pressre)
4. Initiating mode: assist(patient trigger) or control(ventilator only)or both

The newer Ventilators:

Volume-targeted ventilation (VTV)

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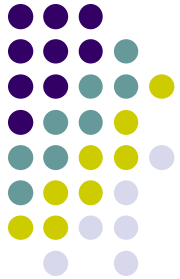


- **VTV enables clinicians to ventilate with less variable tidal volumes and real-time weaning of pressure as lung compliance improves.**

- **VTV compared with time-cycled pressure ventilation results in**
  - **less time on the ventilator,**
  - **fewer air leaks and**
  - **less BPD**

servo-controlled oxygen delivery

- **Modern ventilators now also have the option of servo-controlled oxygen delivery.**
  - This increases time spent in the desired saturation range and reduces hyperoxia
    - but there are no trials to show this improves outcomes

Witch Modes?

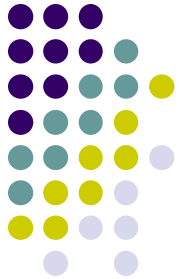
- **CONVENTIONAL VENTILATION:**
  - Volume-Target SIMV+ PS:
    - unless a large (>50%) air leak occurs around the endotracheal tube

or

  - pressure-controlled mode

- **High-Frequency Ventilation**

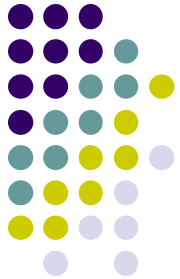
Suggested Initial Approach to Mechanical Ventilation



- **Initiate support:**
  - Slightly higher PEEP (6-to -8 cm H2O)effort to improve recruitment

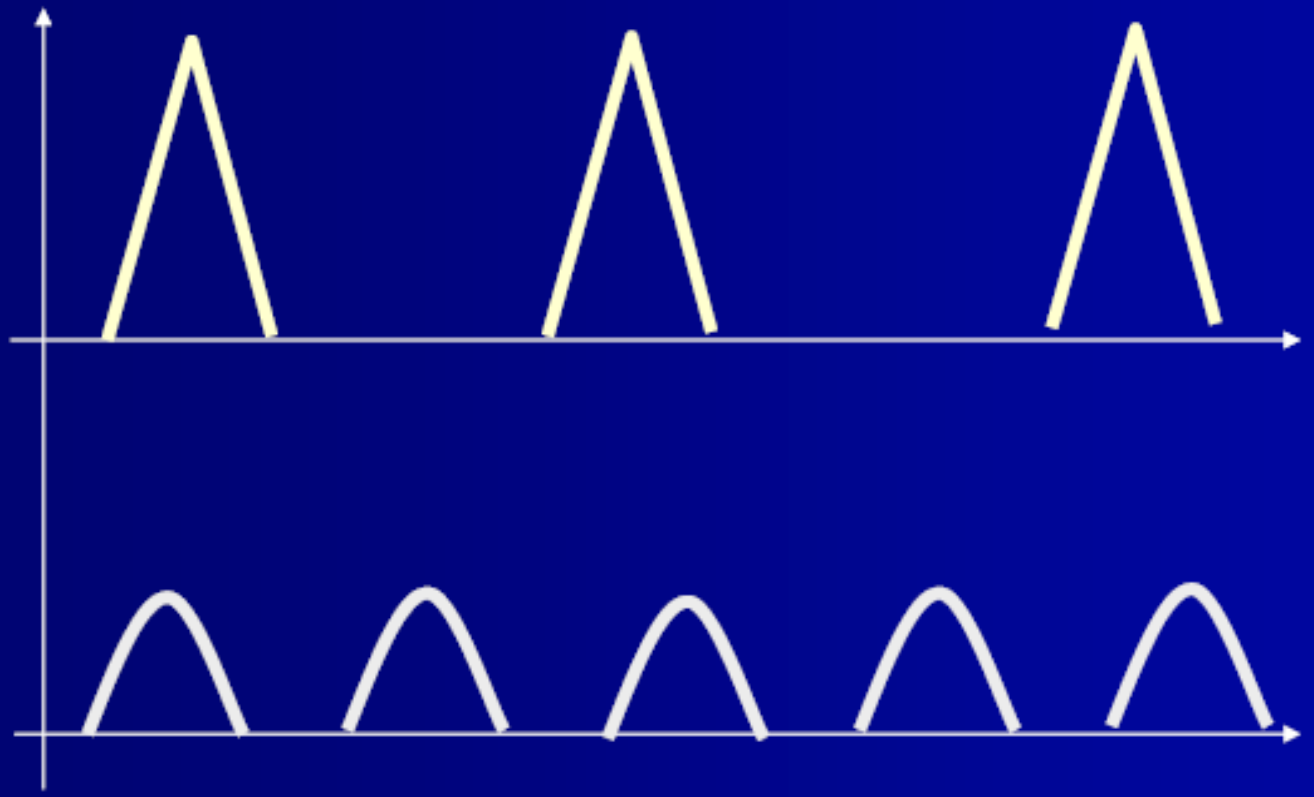
- **Subsequently:**
  - reductions in PEEP are based on FiO2, SpO2, and chest radiographs

Suggested Initial Approach to Mechanical Ventilation

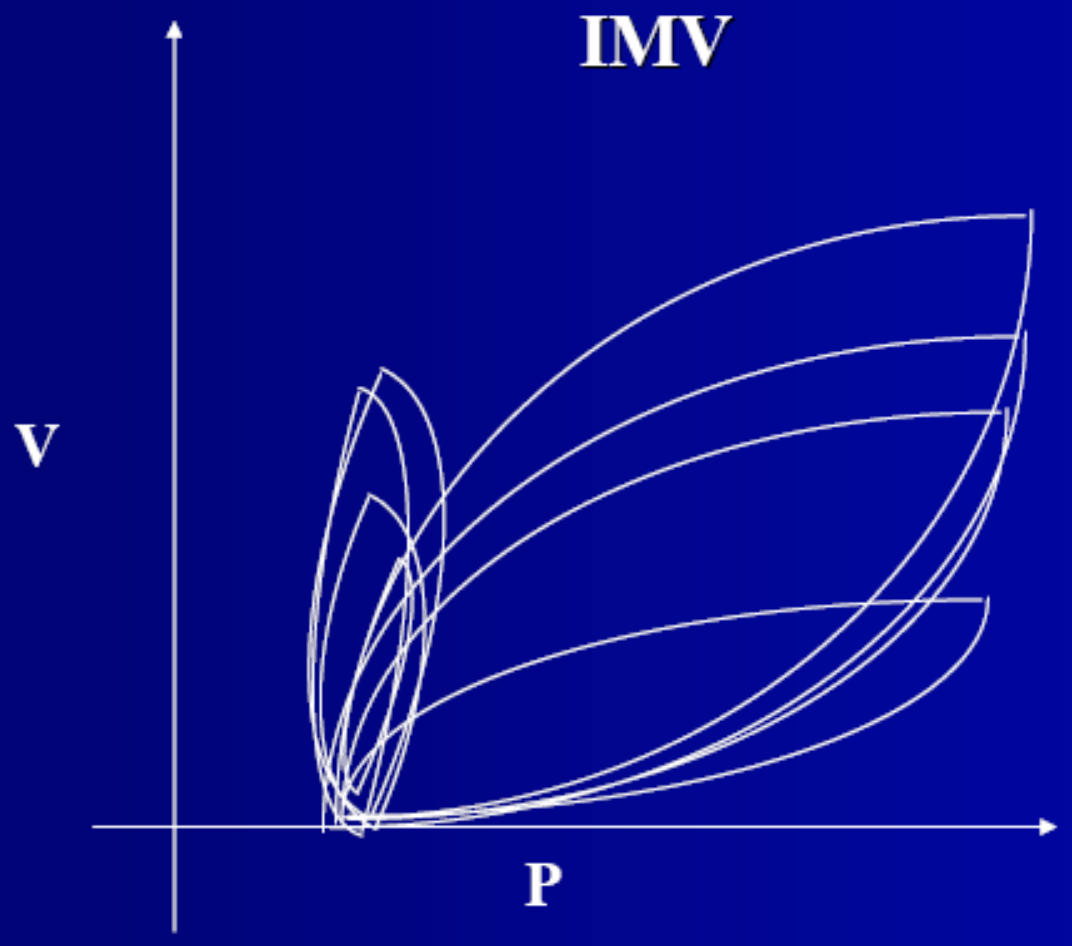


- Surfactant therapy
- Volume target (VT) 4-6 mL/kg
- Rate 30-60 bpm
- I-time 0.30-0.35 seconds
- PEEP 5-8 cm H2O
- PS to achieve ~¾ set PIP

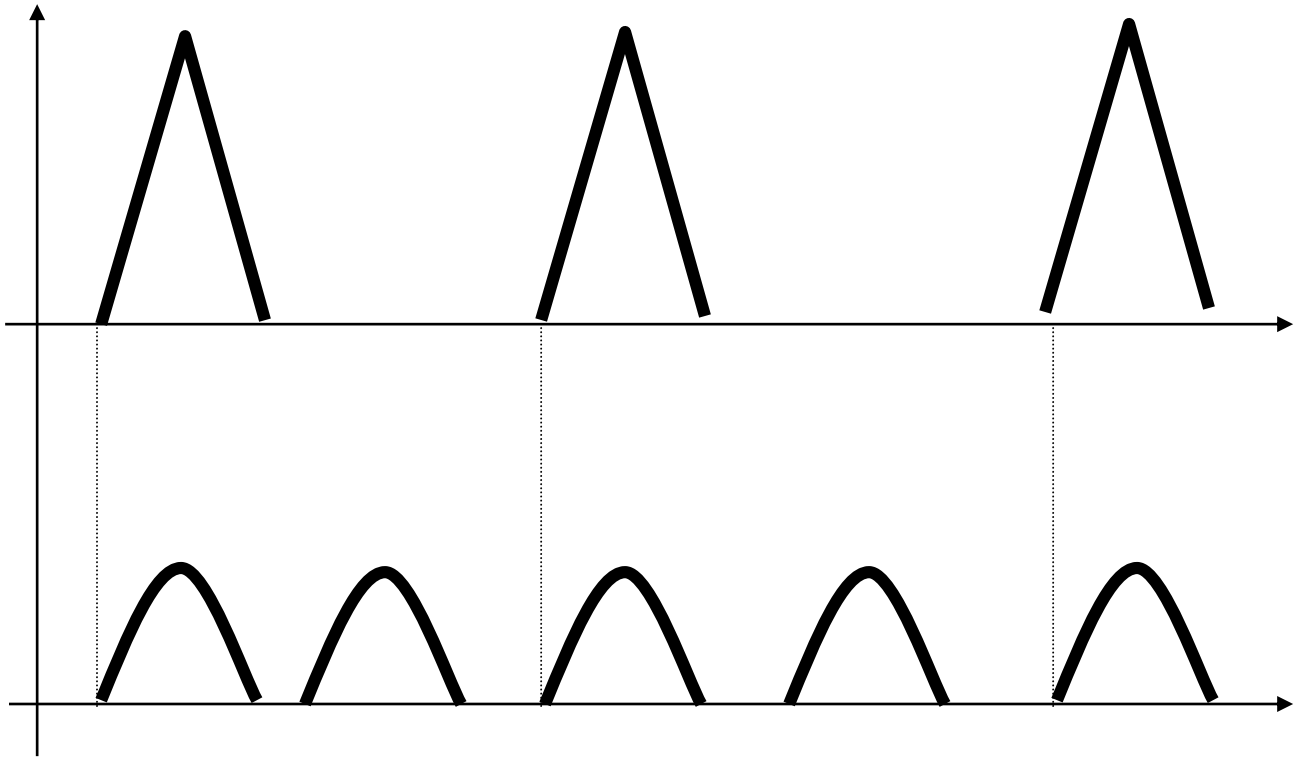
IMV



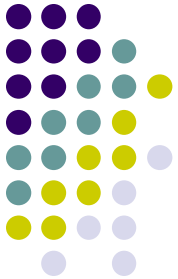
IMV



SIMV

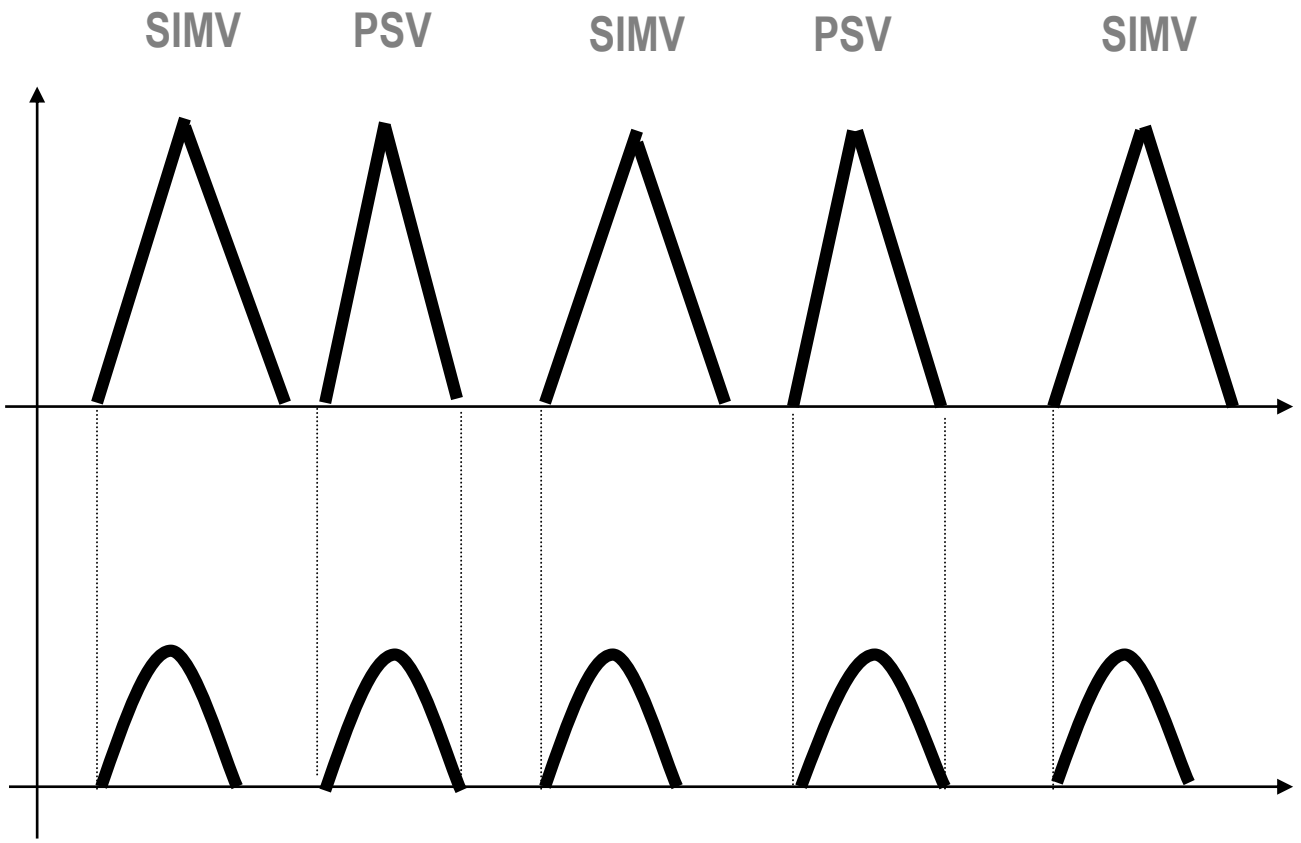


SIMV



- Mechanical breaths are delivered based on Breath Rate setting
- Each mechanical breath is Time Cycled
- Breaths are synchronized with patient's inspiratory effort
- Patient may breathe spontaneously from Base Flow
- No pressure is delivered during spontaneous breaths

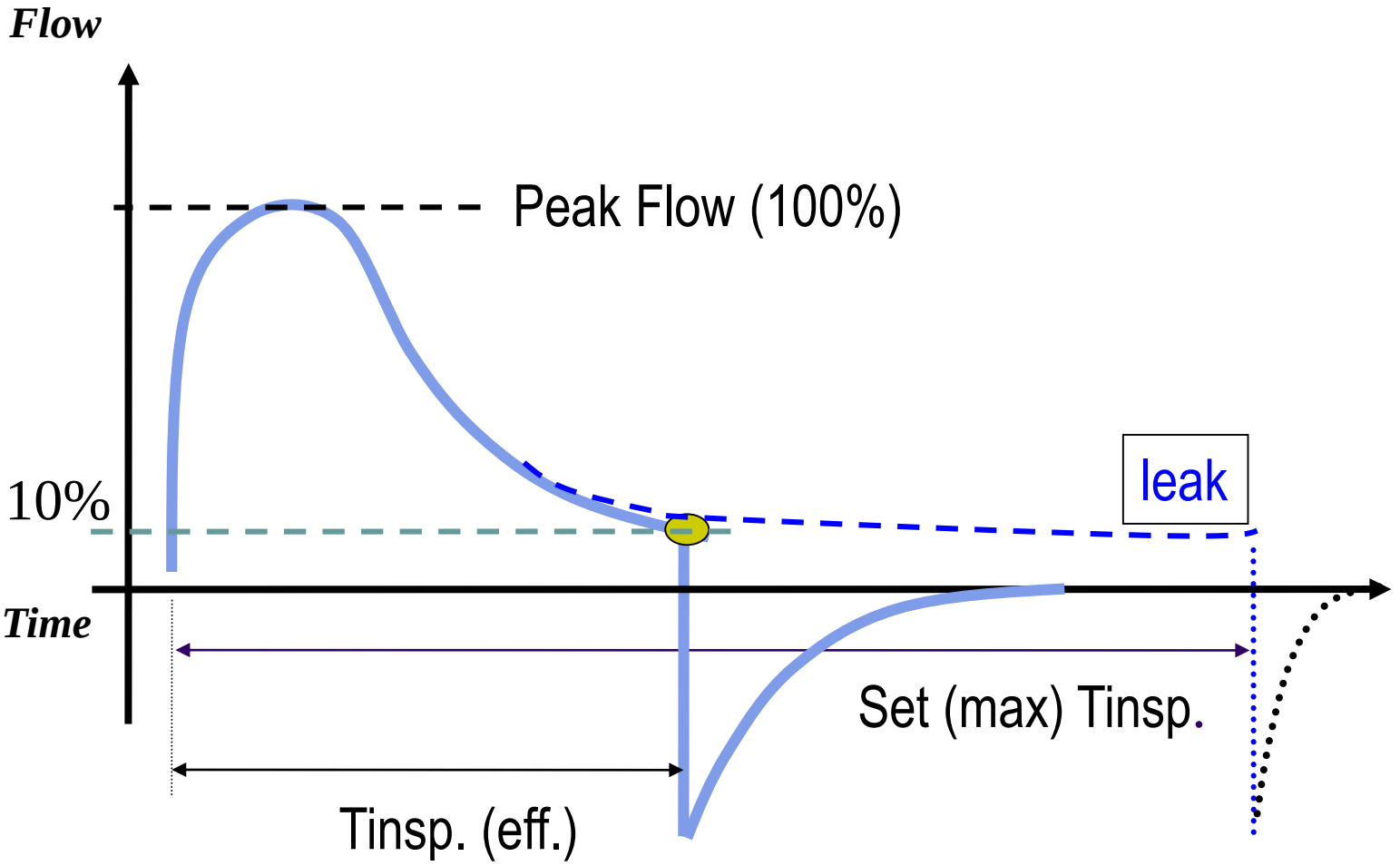
SIMV / PSV



SIMV/PSV

- Breaths delivered at breath rate setting are **Time Cycled**
- Pressure Support breaths are **flow cycled**
- Patient may breath spontaneously and receive Pressure Support

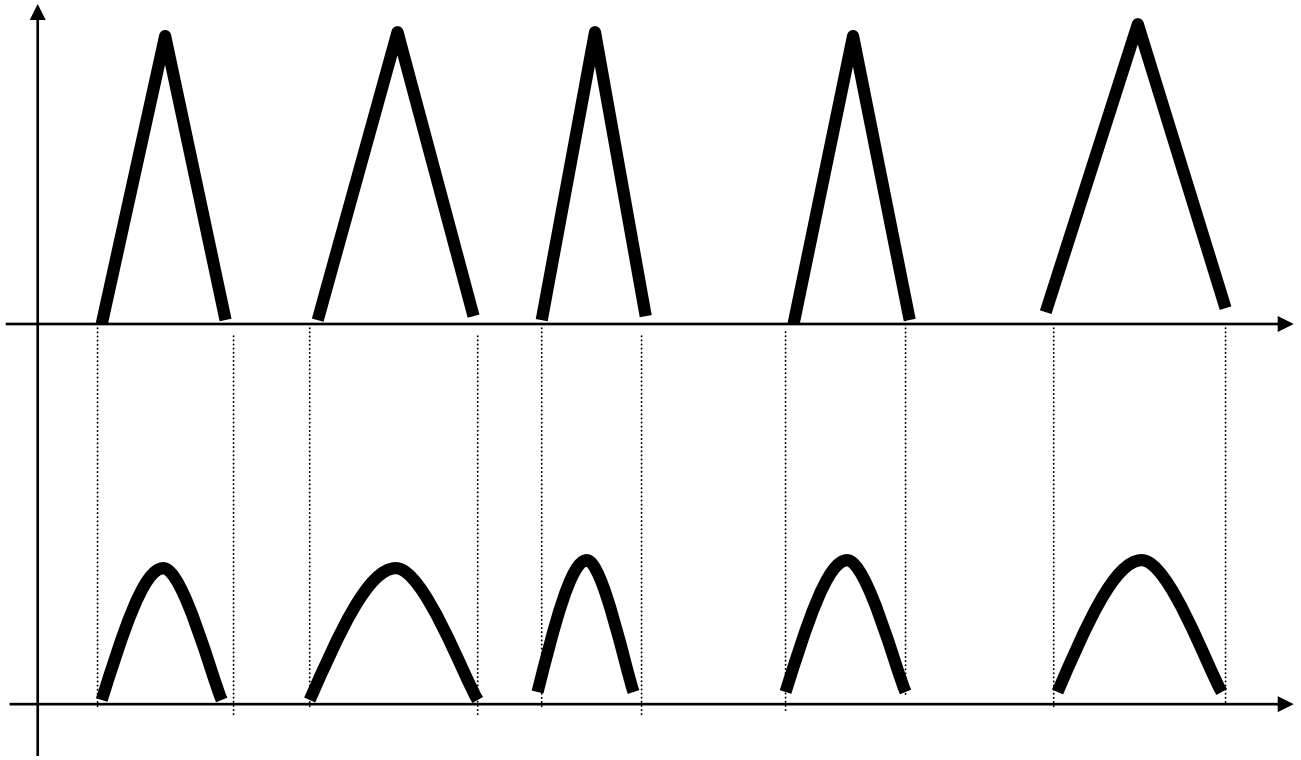
Flow Cycled Ventilation



PSV

- All breaths are flow cycled
- Only patient assisted breaths are delivered
- If no assisted breath is delivered within apnea interval, back up ventilation is initiated

PSV (Apnea Backup Available)



Assist/Control

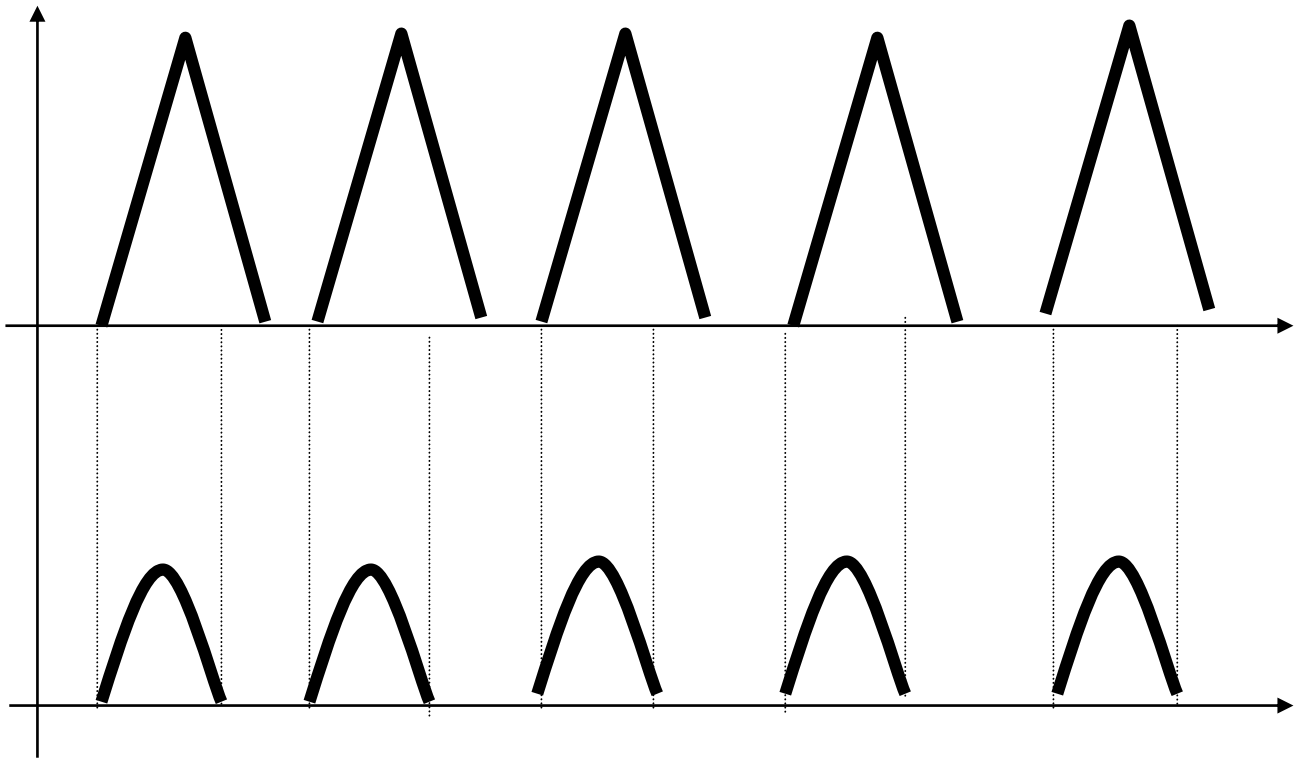


Table 3:
Overview of different ventilation modes and their characteristics

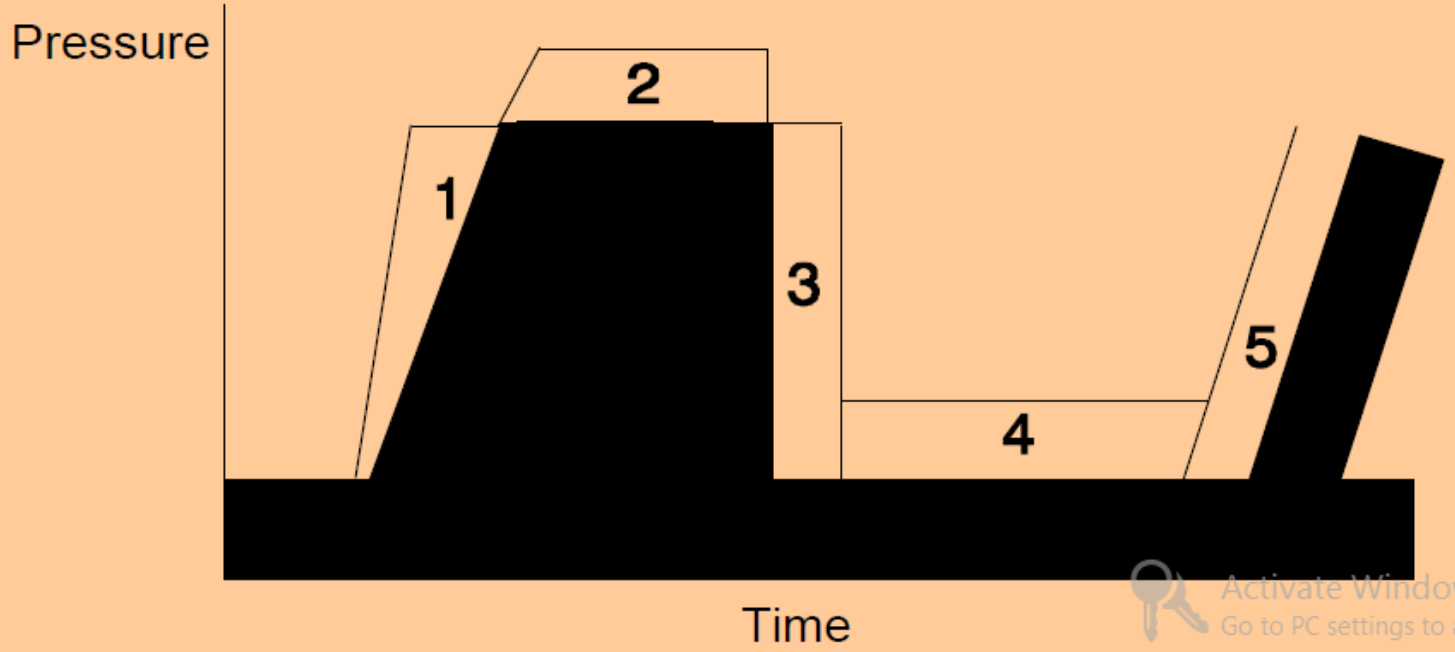
Ventilatory mode	Inspiratory trigger	Assistance of each breath	Ventilator respiration rate	Inspiratory time	PIP
IMV	No	No	Fixed	Fixed	Fixed
SIMV	Yes	No	Fixed	Fixed	Fixed
A/C	Yes	Yes	Variable	Fixed	Fixed
PSV	Yes	Yes	Variable	Variable	Fixed
PSV + VG	Yes	Yes	Variable	Variable	Variable

Increasing MAP

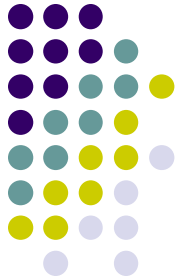
To Increase Mean Airway Pressure

1. Increase flow
2. Increase peak pressure
3. Lengthen inspiratory time
4. Increase PEEP
5. Increase Rate

Pressure Wave



Benefits of FCV



- Improved synchrony between patient and ventilator
- Improved ventilation and oxygenation
- Decreased work of breathing
- Decreased length of ventilation
- Improved patient comfort

Volume Guarantee

Available on the Dräger Babylog

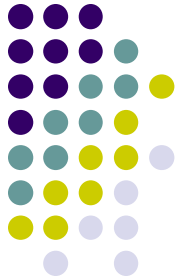
- **Delivers a pressure targeted breath at set inspiratory flow (fixed, not variable flow)**
- **Based on previous breath, pressure may increase or decrease to "guarantee" targeted volume**

Volume Guarantee

Limitations:

- Cannot increase pressure higher than set pressure limit
- Requires a pressure plateau to guarantee volume, which may require
  - Longer inspiratory time
  - Higher flows
- Guarantees Expiratory Volume based on 8 breath average
  - Variability in V_T with leaks and mechanics changes from "catch up"

NICU Ventilation Concerns



- **Barotrauma / Volutrauma**
  - Pneumothorax, PIE, BPD
- **Growth**
  - WOB
    - Decreased with flow triggering and cycling
- **Comfort**
  - Fighting the ventilator
  - Sedation
- **Length of Ventilation Time**
  - Decreased with Flow Cycled Ventilation


Thank
You!