

# APRV

## “Case Report”

❖ Presented by: OMiD Ranjbar  
Nursing Student-6<sup>th</sup> Term  
❖ Supervised by: Mr. Mohammad Rasooli  
MSc in Critical Care Nursing

Experiences Using Airway Pressure  
Release Ventilation for  
Pneumonia with Severe Hypercapnia  
or  
Postoperative Pulmonary Edema

June 2, 2025

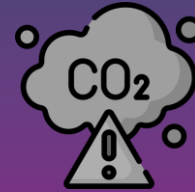
**01**

Ventilation



**02**

Hypercapnia



**03**

Ventilator



**04**

Case Report



**05**

Why APRV?



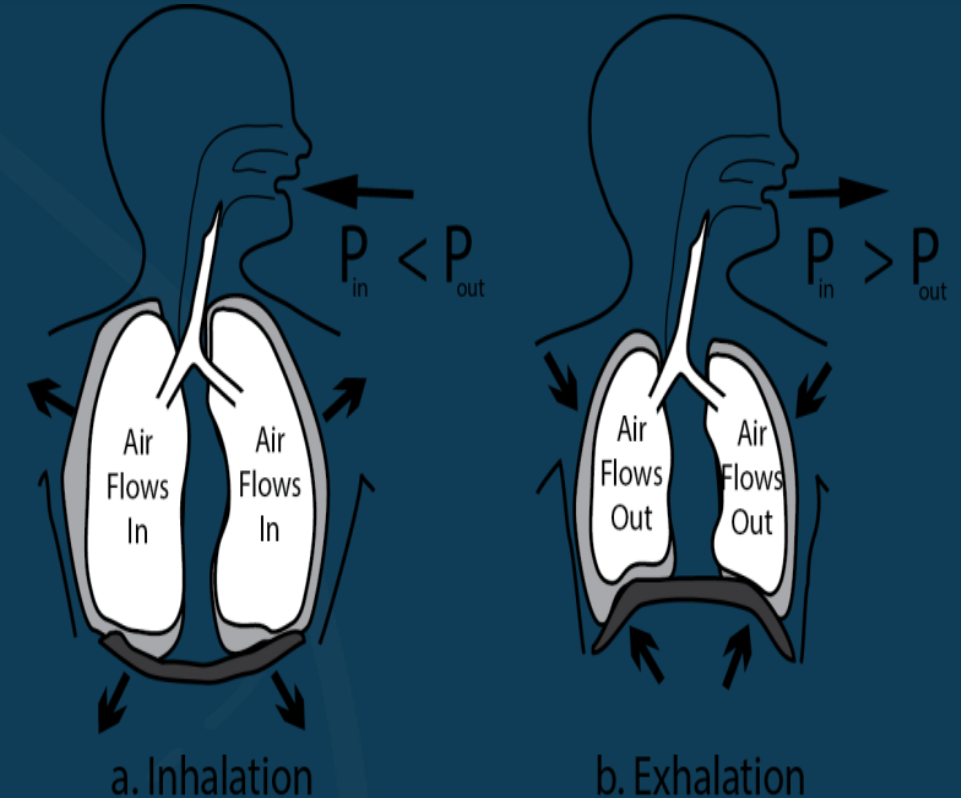
## ● Definition of respiration

- Internal respiration:
- external respiration:

## ● Definition of ventilation

- Definition of mechanical ventilation
- Goal of mechanical ventilation

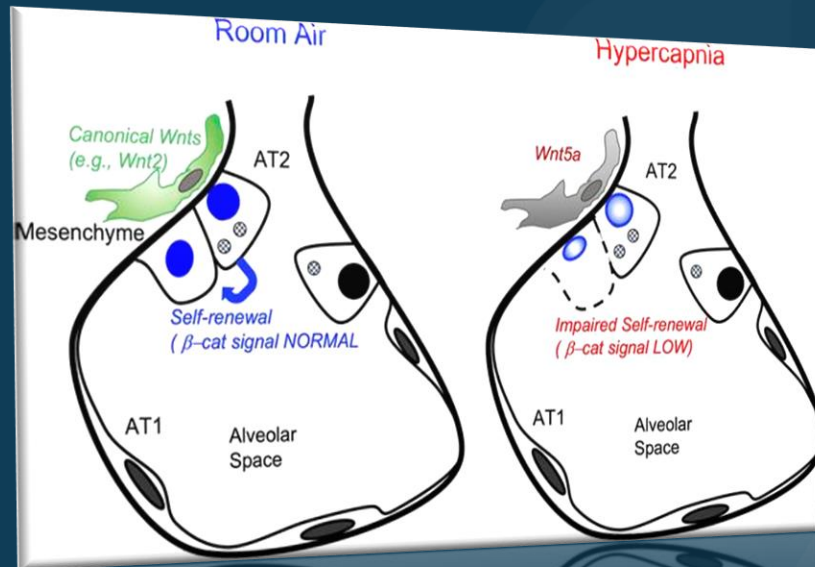
● The goal of mechanical ventilation is not to cure respiratory disease but to support the lungs temporarily until the underlying cause is resolved. It provides the patient's oxygenation and ventilation needs.



# Hypercapnia

## Hypercapnia

Arterial  $\text{CO}_2$  ( $\text{PaCO}_2$ ) > 50 mmHg



### Clinical manifestations

Confusion

↑ Intracranial pressure

Tachycardia

Cardiac Arrhythmia

↓ Level of consciousness

02

# Hypercapnia

**WHAT IS NARCOSIS?**

## ● Basic Function of a Ventilator

- ❖ Compressor
- ❖ Humidifier
- ❖ Control Panel
- ❖ Tubing

## ● Ventilator Modes

- ❖ Volume-Controlled Modes
- ❖ Pressure-Controlled Modes
- ❖ Supportive Modes
- ❖ Dual/Hybrid Modes
- ❖ Spontaneous Modes



## Case 1:(introduction)

**Patient:** 63-year-old female

**Diagnosis:** Advanced breast cancer with liver metastasis

**Previous Medications (Chemotherapy Regimen):**

- ✓ Pertuzumab
- ✓ Trastuzumab
- ✓ Docetaxel



The patient was admitted for her third cycle of palliative chemotherapy, but the treatment was delayed due to the onset of pneumonia



## Case 1:(Pneumonia exacerbation)

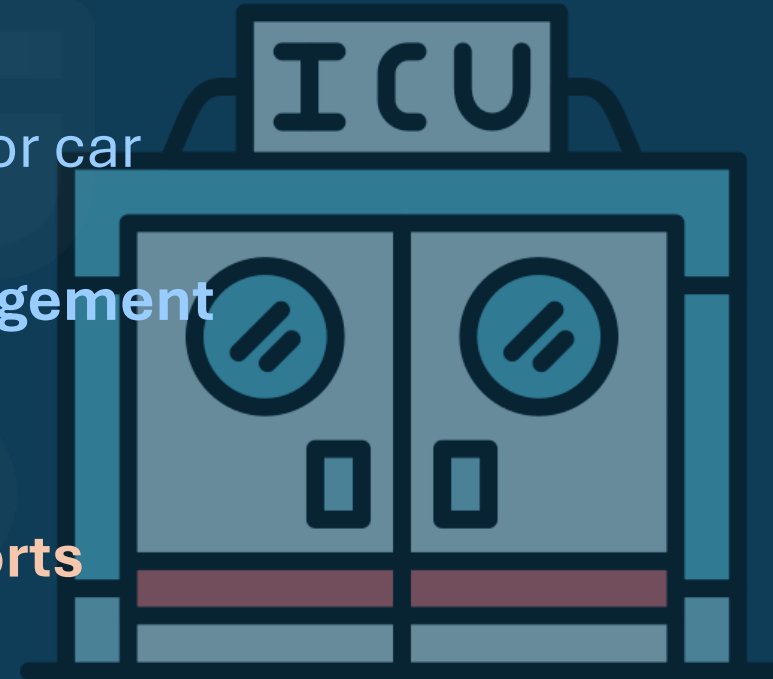
**HD#5:** Transferred to ICU and intubated upon arrival

- ✓ Chest X-ray showed radiologic improvement under ventilator care
- ✗ PaCO<sub>2</sub> levels gradually increased from hospital day 16
- ✗ Hypercapnia progressed despite precise ventilator management

**HD#19:**

pCO<sub>2</sub> reached 69.2 mmHg ⚠

- The patient became **agitated** with **vigorous inspiratory efforts**
- **Respiratory rate** increased from 20 → 24 breaths/min
- **Neuromuscular blockers** were administered to improve gas exchange
- pCO<sub>2</sub> decreased slightly to 60.5 mmHg
- Decision made to switch to **APRV mode**



## Case 1:(APRV)

### APRV Mode Parameters:

- ❖ **Phigh (High Pressure):** 22 cmH<sub>2</sub>O
- ❖ **Plow (Low Pressure):** 10 cmH<sub>2</sub>O
- ❖ **Thigh (Time at High Pressure):** 1.2 seconds
- ❖ **Tlow (Time at Low Pressure):** 0.8 second
- ❖ **FiO<sub>2</sub> (Fraction of Inspired Oxygen):** 35 %



### ABG:

**PaCO<sub>2</sub>:** decreased to 45.0 mmHg

**PaO<sub>2</sub>:** 71.4 mmHg /// **SaO<sub>2</sub>:** 93.8%



## Case 1:(Improvement)

### HD#21:

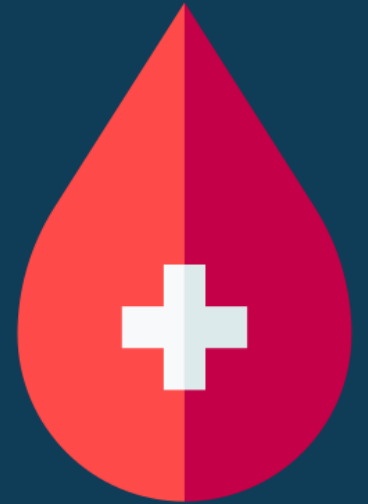
- Ventilation Mode Changed to ASV
- Neuromuscular blockades discontinued
- Ventilator mode: Adaptive Support Ventilation (ASV)

#### Settings:

**Minute Volume: 100%**

**FiO<sub>2</sub>: 35 %**

**PEEP: 10 cmH<sub>2</sub>O**



ABG results showed favorable outcomes

# Case Report 1

## Case 1:(ABG)

|                                          | PCV mode<br>(HD#19) | APVR mode<br>(HD#19) | APVR mode<br>(HD#20) | APVR mode<br>(HD#21) |
|------------------------------------------|---------------------|----------------------|----------------------|----------------------|
| pH                                       | 7.291               | 7.421                | 7.504                | 7.492                |
| pCO <sub>2</sub> (mmHg)                  | 69.2                | 45.0                 | 37.8                 | 37.6                 |
| pO <sub>2</sub> (mmHg)                   | 89.4                | 71.4                 | 73.5                 | 85.8                 |
| HCO <sub>3</sub> <sup>-</sup><br>(mEq/L) | 32.6                | 28.6                 | 29.1                 | 28.1                 |
| SaO <sub>2</sub> (%)                     | 95.7                | 93.8                 | 94.4                 | 96.4                 |
| pO <sub>2</sub> /FiO <sub>2</sub>        | 255                 | 204                  | 210                  | 245                  |
| FiO <sub>2</sub>                         | 0.35                | 0.35                 | 0.35                 | 0.35                 |
| MV(L)                                    | 6.6                 | 9.0                  | 7.5                  | 5.4                  |

# Case Report 2

## Case 2:(introduction)

**Patient:** 63-year-old female

**Diagnosis:** Panperitonitis secondary to colonic perforation following surgery



*The patient was intubated and subsequently transferred to the intensive care unit (ICU)*



# Case Report 2

## Case 2:(Initial management)

### Initial ABG Results (Postoperative Day #1)

- pH: 7.288
- pCO<sub>2</sub>: 38.5mmHg
- pO<sub>2</sub>: 118mmHg
- HCO<sub>3</sub><sup>-</sup>: 17.8 mmol/L
- SaO<sub>2</sub>: 98.9%

### Ventilation Mode: (CMV)

#### Setting:

VT: 470ml

Respiratory Rate: 10 breath/min

FiO<sub>2</sub>: 0.7

PEEP: 5 cmH<sub>2</sub>O



# Case Report 2

## Case 2:(Diagnosis and Treatment in the ICU)

### Initial Suspicion:

- ❖ *Septic shock was strongly suspected.*

### Initial Treatment:

#### Empirical antibiotics:

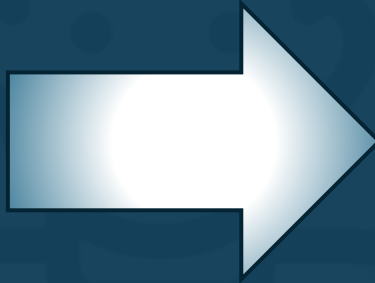
- Ceftriaxone
- Metronidazole

#### Vasopressors:

- Norepinephrine
- Vasopressin

### Supportive therapy:

- CRRT for severe lactic acidosis
- Initial lactate: **9.97 mmol/L**
- Peak lactate: **10.49 mmol/L**



### Response to Treatment:

- *Septic shock improved*
- *Vasopressors discontinued*
- *Lactate levels normalized*

## Case 2:(APRV and Results)

### Persistent Issue:

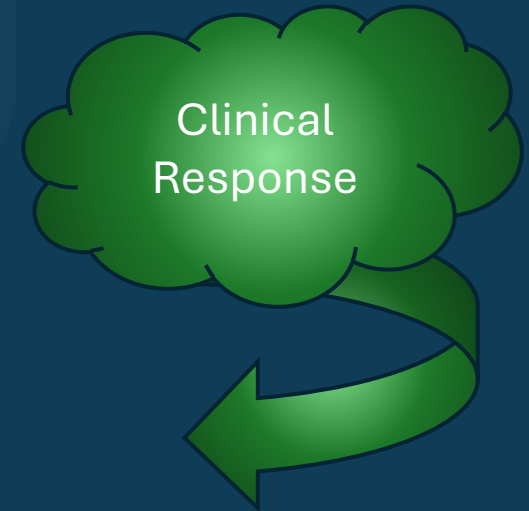
- Despite resolution of septic shock, pneumonia did not improve
- Postoperative pulmonary edema worsened the condition

### Ventilation Change – Postoperative Day #6:

#### APRV Settings:

- P<sub>high</sub>: 34 cmH<sub>2</sub>O
- P<sub>low</sub>: 14 cmH<sub>2</sub>O
- T<sub>high</sub>: 2.0 seconds
- T<sub>low</sub>: 1.0 second
- FiO<sub>2</sub>: 0.5

**Pulmonary edema improved** significantly within hours  
Work of breathing decreased  
APRV continued for **7 days**  
**Follow-up chest X-rays** showed sustained improvement



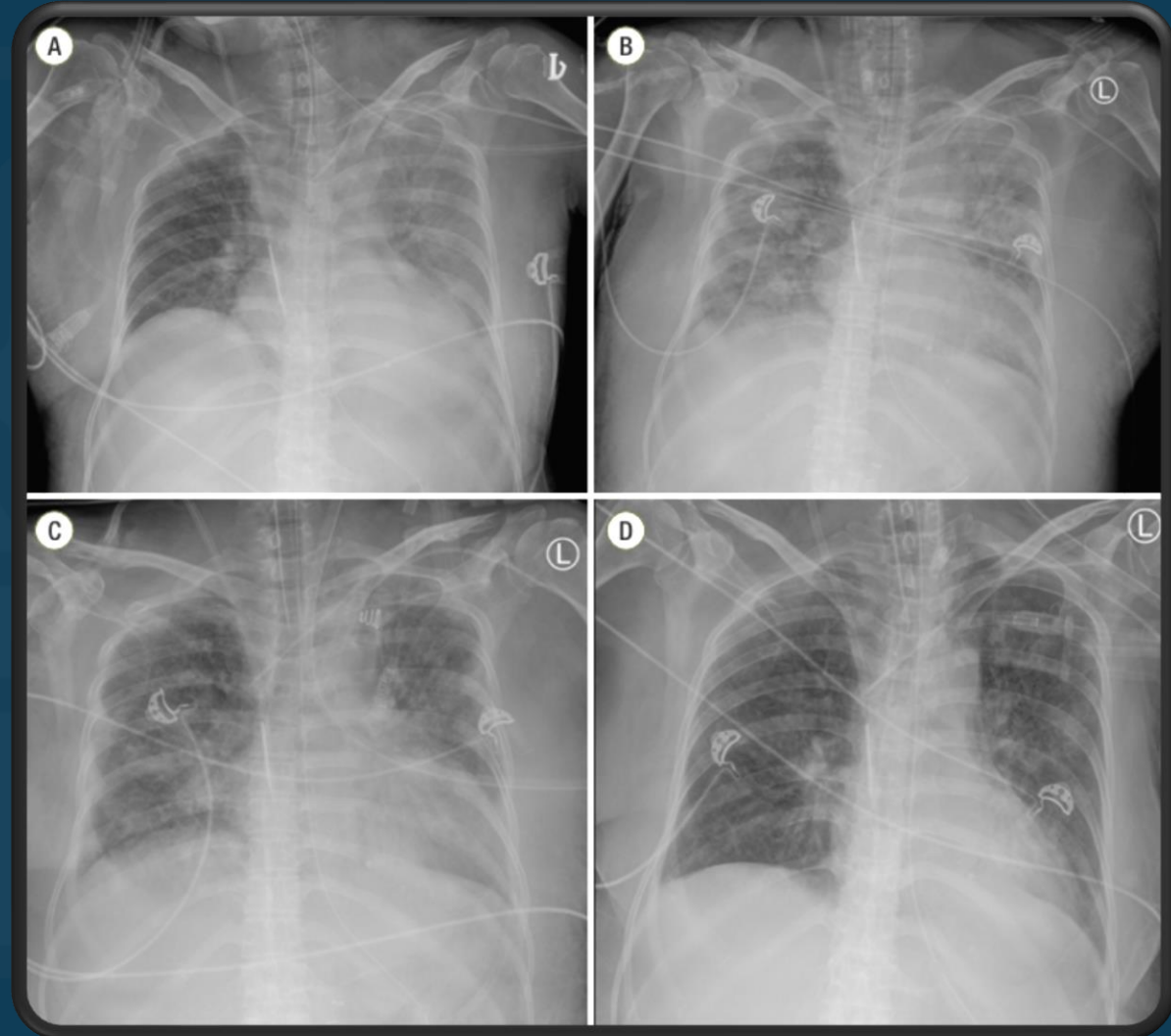
# Case Report 2

## Case 1:(ABG)

|                                          | SIMV-PC<br>mode<br>(POD#6) | APVR mode<br>(POD#6) | APVR mode<br>(POD#7) | SIMV-PC<br>mode<br>(POD#12) |
|------------------------------------------|----------------------------|----------------------|----------------------|-----------------------------|
| pH                                       | 7.444                      | 7.436                | 7.511                | 7.526                       |
| pCO <sub>2</sub> (mmHg)                  | 36.0                       | 35.4                 | 32.0                 | 41.0                        |
| pO <sub>2</sub> (mmHg)                   | 76.6                       | 77.5                 | 179.4                | 119.8                       |
| HCO <sub>3</sub> <sup>-</sup><br>(mEq/L) | 24.1                       | 23.3                 | 25.0                 | 33.2                        |
| SaO <sub>2</sub> (%)                     | 94.7                       | 95.1                 | 99.1                 | 98.3                        |
| pO <sub>2</sub> /FiO <sub>2</sub>        | 109                        | 155                  | 449                  | 300                         |
| FiO <sub>2</sub>                         | 0.7                        | 0.5                  | 0.4                  | 0.4                         |
| MV(L)                                    | 9.1                        | 9.0                  | 9.4                  | 8.9                         |

# Case Report 2

## Case 1:(radiography)



# Why APRV?



Thank you for attention