Modern Anesthesia Machine

Modern anesthesia machine
- advanced ventilation feature
- automated check out
- low flow adaptation
- depending upon electricity
What is new?

- Ventilator: modes, accurate tidal volume
- Adaptation to low flow
- Automated control of end-tidal gas concentrations

Anesthesia ventilator

- Bellow
- Piston
- Blower
Advance ventilator feature
- mode: PCV, PS, SIMV, PCV-VG
- variable PEEP, sensitivity
- accurate tidal volume
- advance monitoring

Ventilator setting
- modes
- tidal volume
- inspiratory flow
- rate, I:E ratio
- PEEP
- sensitivity
- rise time, end of breath
- FIo2
modes

1) CMV: VCV, PCV, PCV-VG
2) SIMV
3) PS

VCV
(volume controlled ventilation)

TV constant
airway pressure: change
monitor: peak airway pressure

adequate flow?
PCV
(pressure controlled ventilation)

- Airway pressure limit
- TV: variable
- Monitor: low tidal volume

- Decelerating flow pattern
- Flow automatic

Lower Peak Pressures

Gas Mixing Time
Why? : PCV

- flow variable
- airway pressure < VCV
- better alveolar recruitment, gas exchange
  (decelerating flow)

When? : PCV

- pediatric, obesity, COPD
- laparoscopic surgery
- LMA
- endotracheal without cuff
- synchronized: ITU

PCV

- P_{control}
- Rate
- I:E: Time
- PEEP
- rise time
- F_{1O2}
Rise time: PCV, PS
- Tslope, rise rate, flow

PLOT SETUP
- Pressure
- Volume
- Flow
- Time
- Respiratory rate
- Insp flow
- PEEP
- MV
- VT
- Freq
- N20, Air, O2

Vent Setup
- Adjust Settings
- Mode: SIMV, PC, PSV
- VCV, PCV
- SIMV/PSV
- PSV/Pro
- SIMV/PC
- PCV/VG
- Spironely
- Normal screen

Slow rise
Moderate rise
Fast rise
• spontaneous breathing
• augment tidal volume
• pressure limit, flow cycle
• variable tidal volume

PSV (PS, PSVPro) (pressure support ventilation)

- comfortable

Why? : PSV

spontaneous breathing
- atelectasis ↓
- gas exchange ↑
anesthesia ; LMA, ET tube
- resistance ↑
- respiration ↓
When? : PSV

LMA (PSV)  
PaCO$_2$ < spontaneous breathing

Pressure support ventilation versus continuous positive airway pressure with the laryngeal mask airway.

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PSV

Psupport    CPAP
Trigger     F$_1$O$_2$
Rise time   End of breath

sensitivity, trigger

flow

- adult: 2-3 L/min
- child: 1-2 L/min
- infant: 0.3-1 L/min
End of breath

PS : flow cycle

25% peak flow

Leak ? : time cycle
**SIMV**

(synchronized intermittent mandatory ventilation)

spontaneous + mandatory breath

 minimimum minute ventilation

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**When ? : SIMV**

spontaneous breath

minimum guarantee

light anesthesia, during emergent
Dual control mode

PCV, guarantee TV

Avance, Aisys : PCV-VG
Pressure controlled ventilation

VT

C_{high}  C_{low}

Flow

Pressure

Autoflow

PCV - VG

VT

Flow

Pressure

When? : PCV-VG

PCV

Automatic : TV
accuracy : TV

- fresh gas flow
- circuit compensation
- leak, sample gas
- oxygen flush valve

**Anesthesia Ventilator**

- **bellow : 2 circuit**
  - inside bellow : flow from flow meter
  - piston : decoupling valve
  - blower : calculated injection
anesthesia ventilator

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TV ???

- 10 cc./kg. PEEP 0-5 cm H$_2$O
- 6-8 cc./kg. PEEP $\geq$ 5 cm H$_2$O
- (plateau pressure < 30 cm H$_2$O)
A trial of intraoperative low-tidal volume ventilation in abdominal surgery.

( IMPROVE study group )

TV 6-8 cc/kg  PEEP 6-8 cm H₂O
recruitment 30 cm H₂O : 30 sec : every 30 min

↓ pulm complication, hospital day, NIV

Perioperative positive pressure ventilation

กราฟชนวน

TV 6-8 cc/kg , PEEP 6-8 cm H₂O
recruitment maneuver ?
RR 12-25 breaths/min
F₁O₂ 0.3-0.5

plateau pressure < 25 cm H₂O , S_pO₂ > 95%

Automated control of end-tidal gas concentration

low flow
decrease cost, environment pollution
set : % oxygen, minimal flow, ET-volatile
manual : % oxygen, FGF, % vaporizer
safety : use only one agent, leakage
monitor
ET O₂
ET volatile

Thank you