

【呼吸治療師可信賴專業活動-EPAs 課程規劃及評量影片設計競賽】

團隊名稱：雙和醫院呼吸治療室

負責主題：(EPAs-6)使用侵襲性呼吸器病人之初始設定及照護

團隊代表人：張哲榕 呼吸治療師



重要聲明

本影片使用於非營利的教學用途，已由影片提供者確認涉及肖像權及個資等，有取得當事人同意，提供中華民國呼吸治療師公會全國聯合會及台灣呼吸治療學會無償放置在網頁中，限由兩會所屬呼吸治療師會員自由使用，但須載明來源。

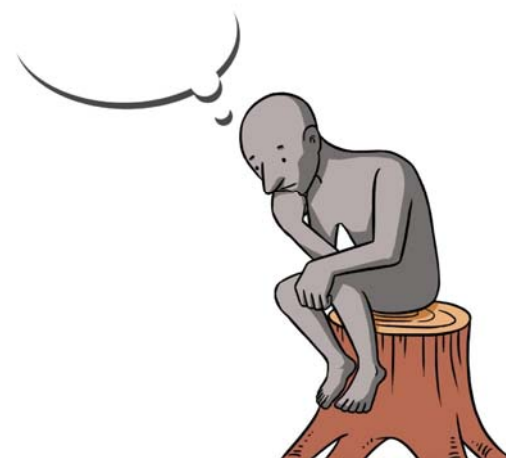
成人重症暨綜合呼吸治療臨床實習核心課程

使用侵襲性呼吸器病人 初始設定及照護



雙和醫院 呼吸治療室 張哲榕 呼吸治療師

承接侵襲性呼吸器病人 可能遇到的風險與錯誤？

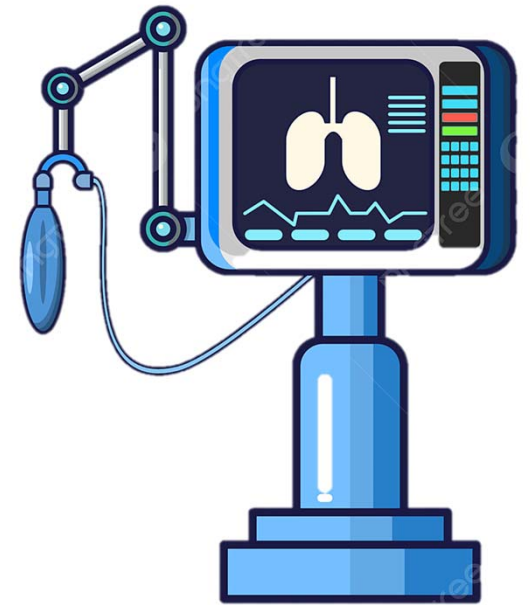


病人安全的省思

事前準備-呼吸器備機

呼吸器備機流程

- 呼吸治療師收到備機通知後
- 選擇適當的呼吸器 (電源、氣源、模式、管路)
- 完成初始模式、參數及警報設定
- 備機模式：Dual control modes
- 接上測試肺通氣，確認呼吸器持續正常運作
- 完成備機流程



呼吸器備機流程

- 正確安裝呼吸器管路及準備呼吸器
- 將呼吸管路依照進吐氣端與呼吸器正確接合。
- 呼吸器進氣端接上靜電薄膜式細菌過濾器，呼吸器吐氣端接上 HEPA 細菌過濾器。
- 將呼吸器電源插頭接於不斷電插座上。
- 將呼吸器氧氣及空氣高壓管接於氣體牆上之高壓氣體出口。
- 呼吸器功能測試正常
- 通過 Self test、Air tight 及 Check 測試（適用於 Drager 系列）。
- 通過 Self test、Tightness 及 Flow sensor calibration 測試（適用於 Hamilton 系列）。

呼吸器備機流程

- Dräger series (Evita4 , EvitaXL, V600)

Mode: VC-AC

VT: 500 ml

RR: 12 bpm

FiO2: 100%

Ti: 0.8-1.2 sec

PEEP: 6 cmH2O

Flow trigger: 2 L/min

Autoflow: On

Alarm setting



呼吸器備機流程

- **Hamilton Series (Galileo, G5, C3)**

Mode: APV mode

VT: 500 ml

RR: 12 bpm

FiO₂: 100%

Ti: 0.8-1.2 sec

PEEP: 6 cmH₂O

Flow trigger: 2 L/min

Alarm setting

承接新病人-給予適當設定

連接呼吸器於病人之人工氣道

- 確認氣管內管或氣切造口位置正確、氣囊功能與固定妥當。
- 將呼吸器連接於病人之人工氣道上。
- 適當設定呼吸器參數
 - ① 依病患基本特徵、初步診斷
 - ② 血氧濃度、動脈血液氣體分析結果、呼吸型態
 - ③ 肺機械力學
 - ④ 呼吸型態及生命徵象
- 使用呼吸器管路固定架適當支持呼吸管路
- 過程避免拉扯到人工氣道。





適當設定呼吸器參數

■ Predicted body weight (PBW)

- 公式 $PBW = (\text{Height}_{(m)})^2 \times 22$

■ Minute Ventilation (V_E)

- Minute Ventilation = $V_T \times RR$
- 公式1 Male = $4 \times BSA$ / Femal = $3.5 \times BSA$
- 公式2 $PBW \times 100(\text{ml/kg}) \div 1000$

■ Tidal volume (V_T)

- Adult : 8 mL/kg (PBW)

■ Respiratory rate (RR)

- 12~20 bpm





適當設定呼吸器參數

- Trigger sensitivity: Flow trigger 1-2 lpm
- Inspiratory time (Ti)
 - To achieve Ti 0.8~1.2 sec
- Positive end-expiratory pressure (PEEP)
 - Initial : 5-6 cmH₂O
 - BMI > 30 or FiO₂ > 60 → set 8cmH₂O
- FiO₂ — Adjust FiO₂ to achieve SpO₂ > 92%
- Alarm and limit

Pressure control ventilation (PC/AC) – Initial setting

■ Inspiratory Pressure (P_{insp})

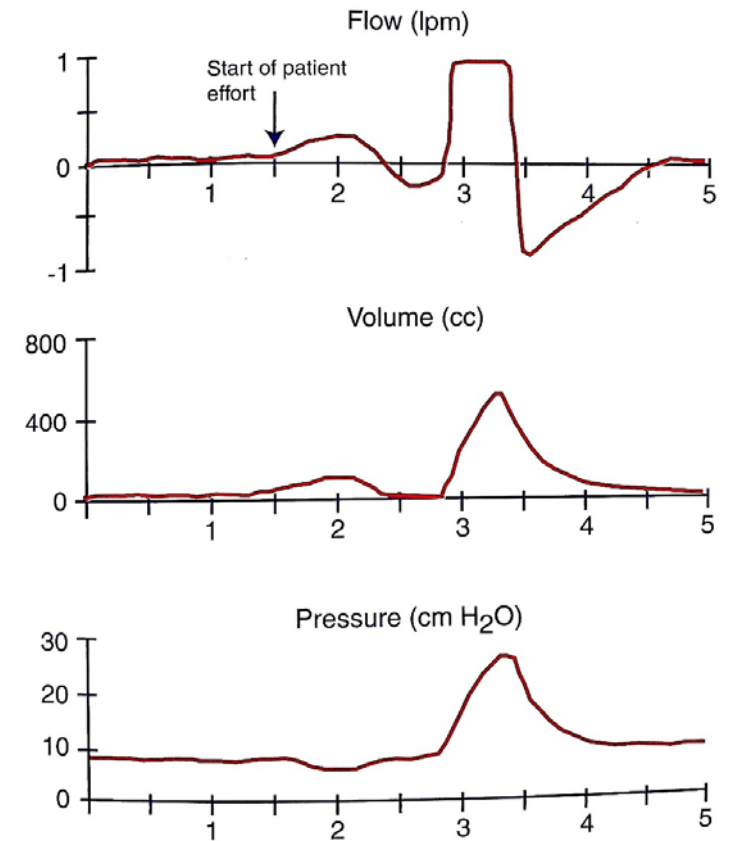
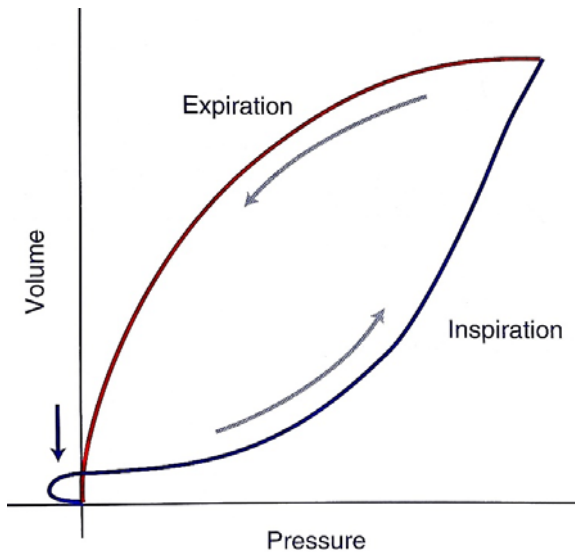
- Initial pressure (ΔP) : 10 ~ 15 cmH₂O (Above PEEP) → To achieve target V_t
- Peak inspiratory pressure (PIP) < 30 cm H₂O
- Dual control modes 下 (P_{plat}-PEEP) → PC/AC 設定之 Initial pressure (ΔP)





靈敏度設定

- 引動方式首選— Flow trigger
 - ① 吐氣閥在Flow trigger引動期間不需關閉
 - ② 吐氣期維持管路內氣流→吸氣控制閥保持開啟
 - ③ 提供即時流速需求





警報設定

警報值	設定值
Low Pressure	PIP - 5~10cmH ₂ O
High Pressure Alarm	PIP + 10cmH ₂ O
Low PEEP Alarm	設定PEEP - 2~5cmH ₂ O
High VT Alarm	+ 10~15% VT
Low VT Alarm	- 10~15% VT
High MV Alarm	+ 10~15% MV
Low MV Alarm	- 10~15% MV
Apnea Time	20 sec



濕熱交換器(HME)

濕熱交換器(HME)

- 理想濕熱交換器：標準接頭、低管路順應性、低無效腔、低阻力、輕量。
- 無效腔：40-100ml (本院43ml)
- 高容積、高呼吸速率、高吸氣流量、高FiO₂ → 效率降低
- 不可使用大於 96小時

吸濕性溼熱交換器(HHMEs)

- 濕熱效率較高 70%
- 低導熱元件(紙、毛織物、泡棉)
- 濕氣輸出 22 ~ 34 mgH₂O / L



HME禁忌症

- ✓ 分泌物濃稠、增加、缺乏水分
- ✓ 體溫過低(<32度C)
- ✓ 潮氣容積太大(Vt > 700ml)
- ✓ 潮氣容積太小(HME容積 > Vt的30%)
- ✓ 大量漏氣
- ✓ 吐出的Vt < 吸入Vt 的70%
- ✓ 執行氣霧治療時
- ✓ 不可搭配加熱加濕



適當設定呼吸器參數

- 急診肺炎
- 低血氧性呼吸衰竭
- 身高172 PBW:65 kg
- V_E : 6.5 L/min

根據特定疾病類別 給予適當呼吸器設定

Specific patient situations

- COPD
- Asthma
- Acute brain injury
- ARDS
- Cardiogenic Pulmonary Edema & CHF
- Post-operative



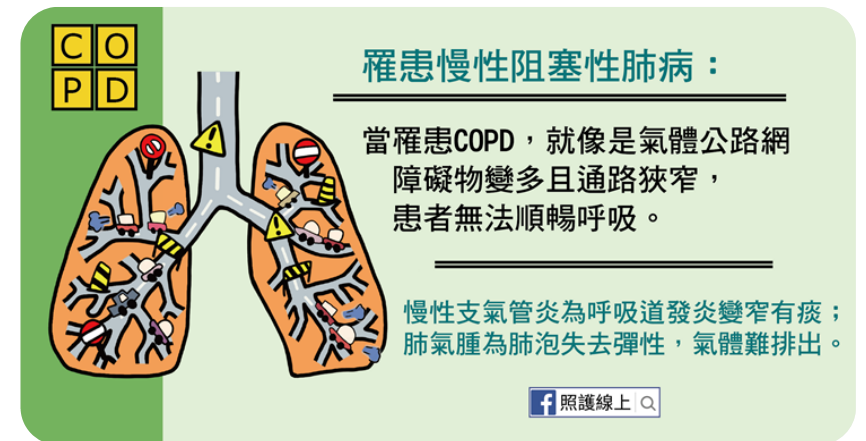
COPD

- 常見問題:

Airway obstruction (inflammation、excess mucus)

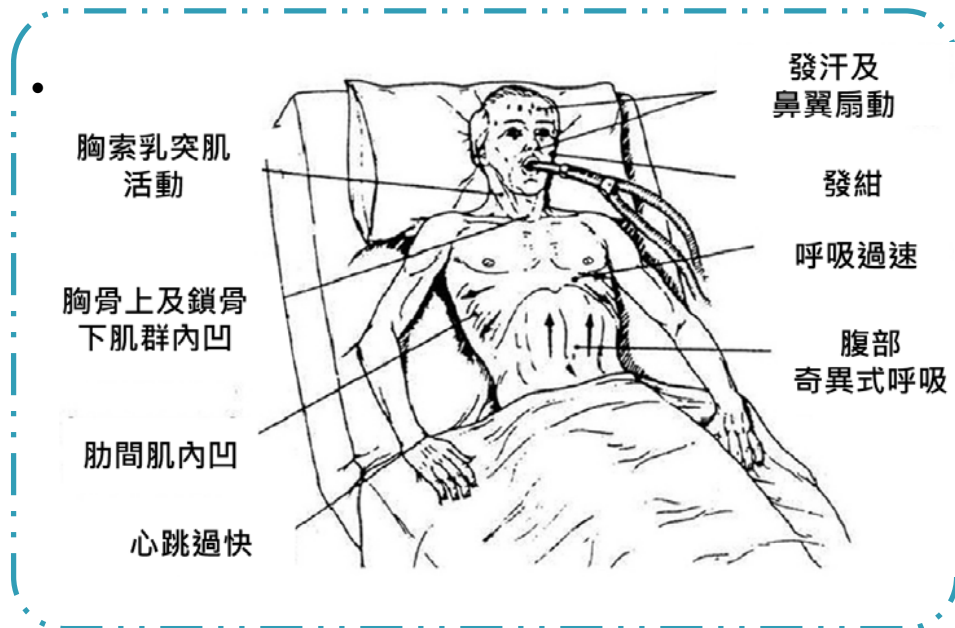
Alveolar membranes break down (hyperinflation)

- ① Increase WOB : Accessory muscle use
- ② Air trapping、Flattened diaphragm
- ③ \uparrow FRC \uparrow TLC
- ④ \uparrow Airway resistance / possible \uparrow CL



Ventilator Strategy - COPD

- NPPV is now considered a first choice of ventilation to avoid invasive ventilation



- NPPV failure:
 - ① $\text{PaO}_2 < 40 \text{ mmHg}$ or $\text{PaO}_2/\text{FiO}_2 < 200 \text{ mmHg}$
 - ② $\text{pH} < 7.25$ $\text{PaCO}_2 > 60 \text{ mmHg}$
 - ③ Respiratory > 35 min
 - ④ Severe dyspnea (paradoxical abdominal motion)
 - ⑤ Hemodynamic unstable

Initial ventilator settings for COPD

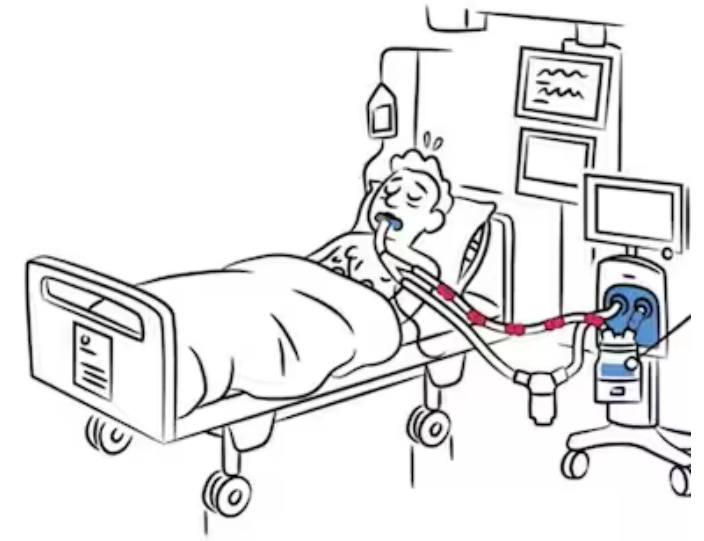
- 機械通氣目標:

- ① Peak inspiratory flow rate to meet the patients demand
- ② Patients-ventilator synchrony
- ③ Reduce WOB
- ④ Minimize air-trapping and auto-PEEP
- ⑤ Eliminate PaCO₂
pH > 7.3-7.4 / PaCO₂ < 50 mmHg
PaCO₂ maintain at patient' s baseline (For chronic hypercapnia)
- ⑥ Avoid complication (hyperventilation、Barotruma)

Initial ventilator settings for COPD

- Initial Setting For COPD Patients

參數	設定值
Mode	PC/AC (Flow to meet patient' s demand)
VT	6-10 mL/kg
RR	8-16 bpm
Ti	0.6-1.2
PEEP	5~6 cmH2O(可將PEEP設定為80% AutoPEEP數值)
P plateau	<30 cmH2O
I/E	≥1:4 (減少Ti, 拉長Te)
FiO2	Keep SpO2 >90% or PaO2 55-75 mmHg



Asthma

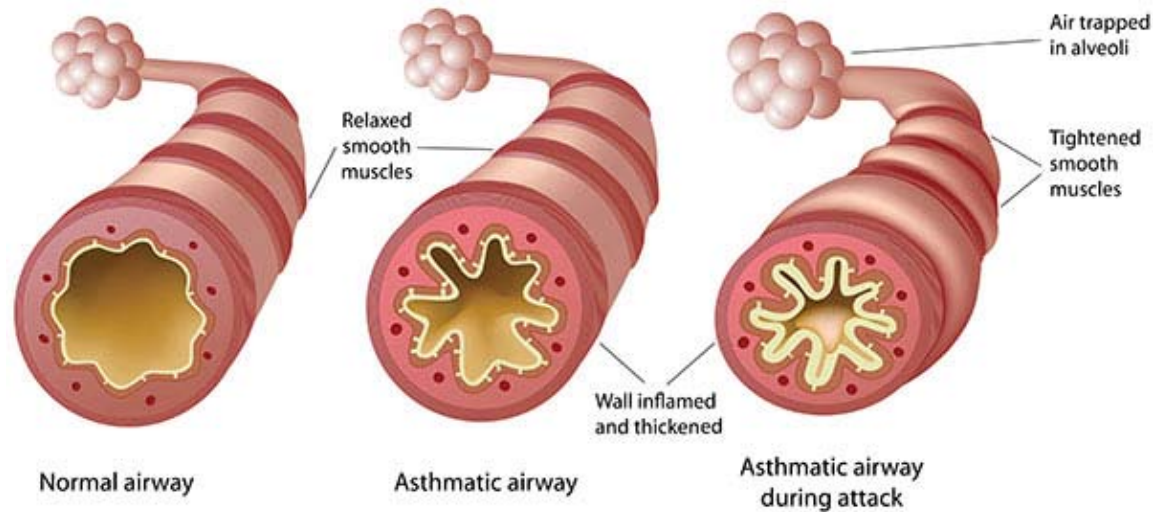
- 常見問題:

High Raw : bronchospasm 、 mucosal edema 、 secretions

Air-trapping : Increase FRC 、 excessive WOB 、 barotrauma

Hypoxemia

Anxiety



圖片來源 : Ophea Asthma Friendly website

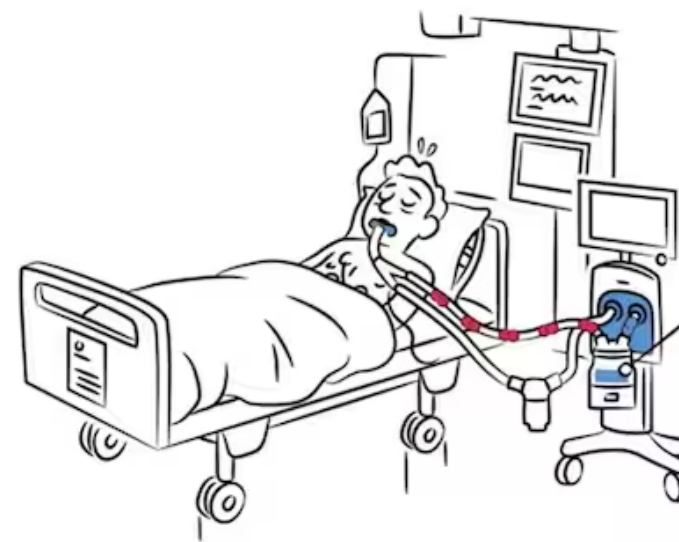
Initial ventilator settings for COPD

- 機械通氣目標:
 - ① Reversal of the high Raw
 - a. Bronchodilator inhalation / MgSO₄ / Corticosteroid
 - b. Monitor Raw (static) / Breathing sound
 - ② Avoiding or reducing air-trapping
 - a) Setting PEEP at about 80% of auto-PEEP
 - b) Applied PEEP may recruit collapsed alveola and assist with expiraotry flow
 - ③ Permissive hypercapnia is acceptable
 - a) Keep pH > 7.25 and PaCO₂ 45 to 80 mmHg
 - ④ Patients-ventilator synchrony → Sedation and paralysis during the first 24 hrs.
 - ⑤ Endotracheal tube size

Initial ventilator settings for Asthma patient

- Initial Setting For Asthma Patients

參數	設定值
Mode	VC-AC (Easier to monitor Raw and Pplat) PC-AC (Easier to keep airway pressure)
VT	4 to 8 mL/kg
Flow	Constant: 60-80 L/min Decelerating: 80-90 L/min
RR	10-12 bpm
Ti	0.6-1.0
PEEP	5~6 cmH ₂ O(可將PEEP設定為80% AutoPEEP數值)
P plateau	<30 cmH ₂ O
I/E	>1:3 (減少Ti, 拉長Te)
FiO ₂	Keep SpO ₂ > 92% or PaO ₂ 60-100 mmHg



Acute brain injury

- **Acute brain injury:**

Traumatic brain injury (TBI)

Acute ischemia stroke (AIS)

Subarachnoid hemorrhage (SAH)

Intracerebral hemorrhage (ICH)

- **常見問題**

Unconscious status (GCS \leq 8) → Unable to protect airway.

Cerebral edema / Cerebral perfusion / or IICP

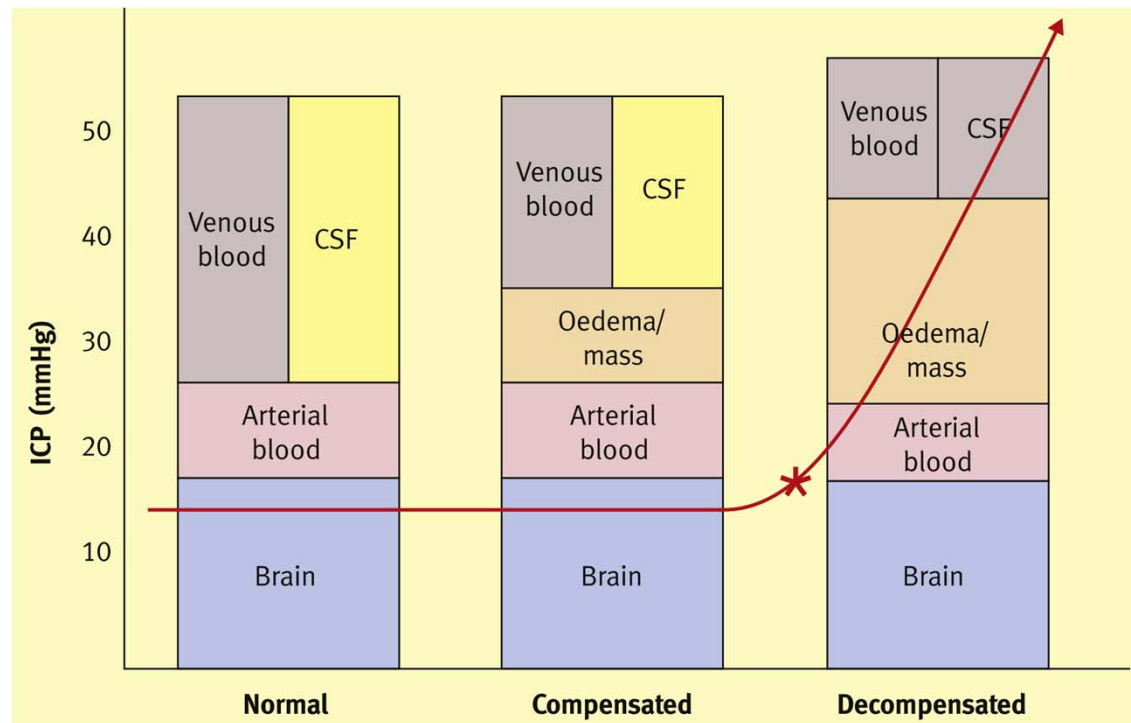
Inadequate respiratory drive

Cerebral Perfusion Pressure (CPP)

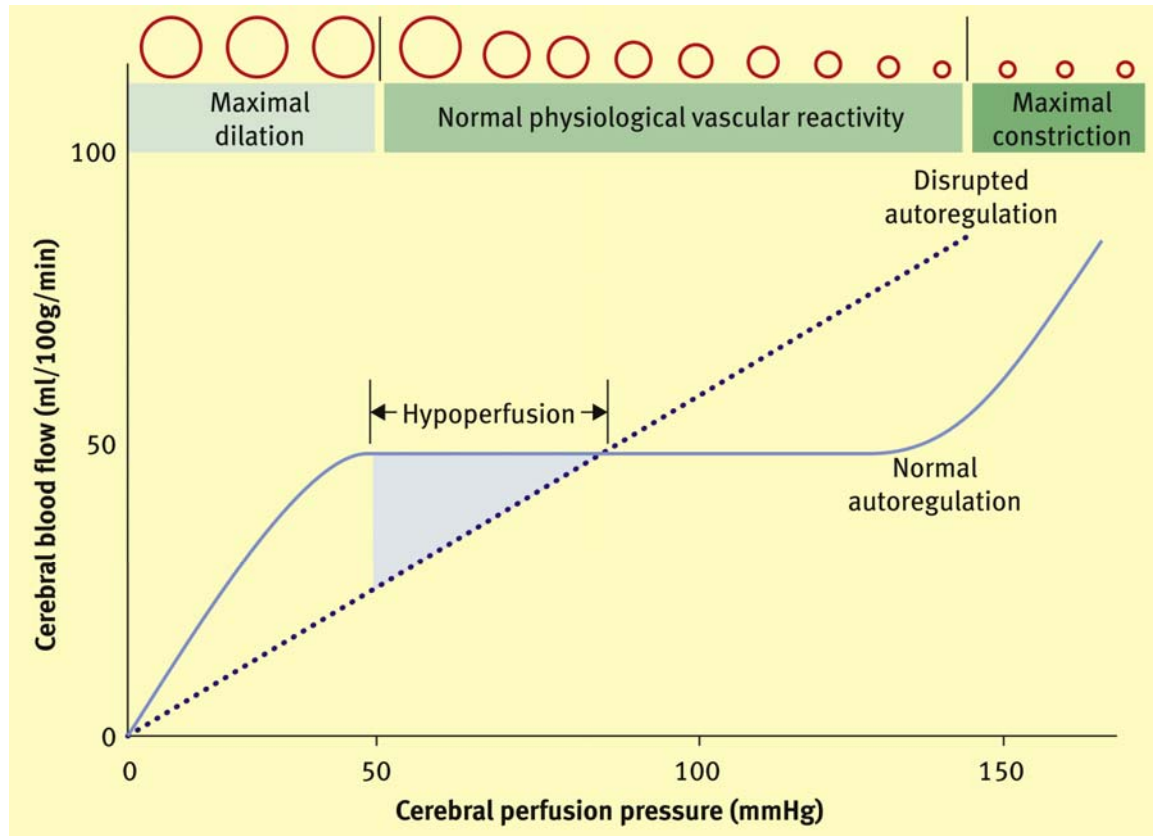
= Arterial mean pressure (MAP) – Intracranial Pressure (ICP)

Auto-regulatory mechanisms for keeping ICP

Once auto-regulatory mechanisms for keeping intracranial pressure (ICP) within tight limits are exhausted, decompensation occurs and ICP rises exponentially



Cerebral Auto-regulatory



Maintain CPP

- Keep ICP low and MAP in normal
- **Mannitol** to increase osmotic pressure and reduce ICP
- **Diuretics** to reduce fluid (may reduce MAP, ICP)
- **Head elevated by 30 degrees.**

CPP = MAP - ICP

Cerebral Perfusion Pressure (CPP)

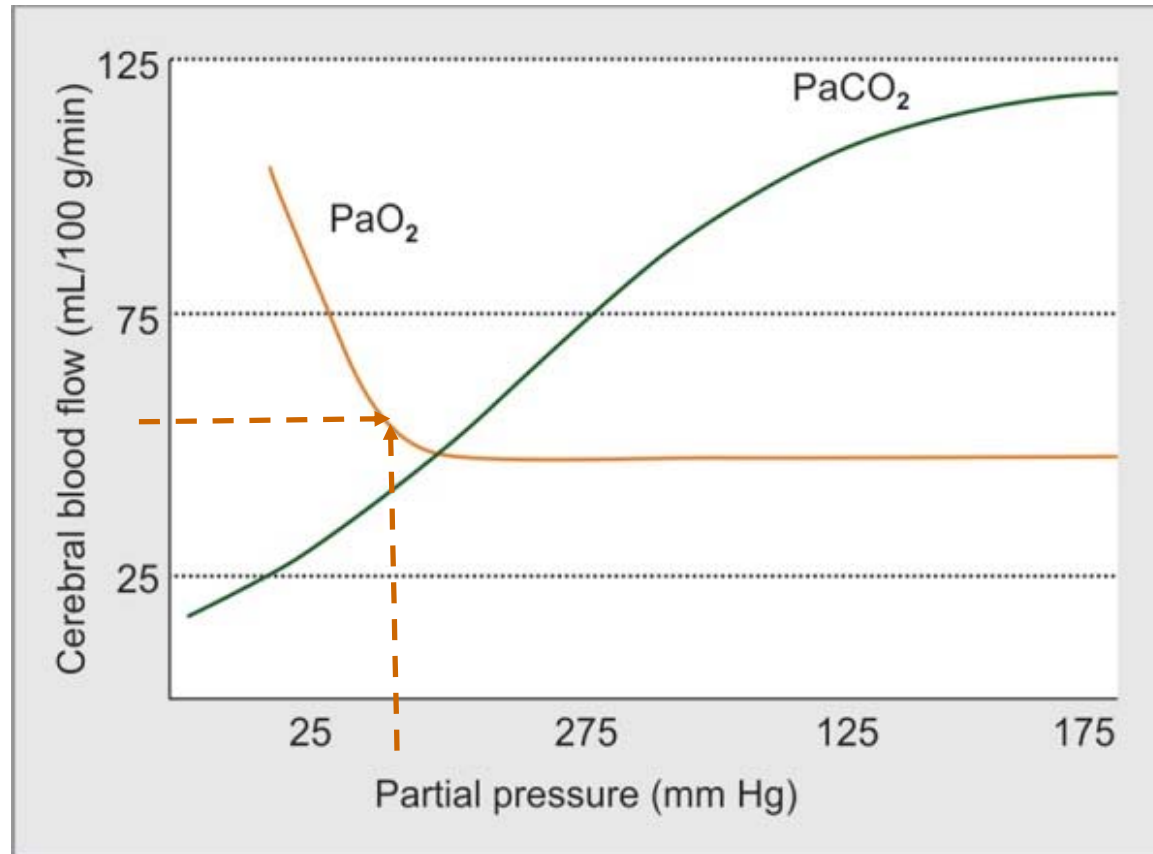
= Arterial mean pressure (MAP) – Intracranial Pressure (ICP)

Cerebral Perfusion Pressure (CPP) : 至少 60 至 70 mm Hg

= Arterial mean pressure (MAP) : 80 至 110 mmHg

= Intracranial Pressure (ICP) : <10~15mmHg

PaCO₂ & PaO₂ / Cerebral blood flow



(PaCO₂) 35-40 mmHg : Normal range.

(PaO₂) 50 mmHg : The threshold where hypoxia begins to influence cerebral blood flow

Initial ventilator settings for Acute brain injury

- 機械通氣目標:

- ① ~~Iatrogenic hyperventilation~~ → ~~PaCO₂ to between 25-30 mmHg~~
- ② PEEP ≥ 10~12 cmH₂O : in Crs normal patients → Decrease CPP
- ③ PEEP ≥ 10~12 cmH₂O : in Crs decrease patients → Not affect CPP
- ④ ~~Vt ≥ 10 ml/kg : ↑ Acute brain injury complicated ARDS~~
- ⑤ PaCO₂:35~40mmHg : PaCO₂下降，血管收縮；PaCO₂上升，血管舒張
PaCO₂太低→血管收縮→CBF下降 / ICP下降 → 缺氧
PaCO₂太高→血管舒張 →CBF上升 / ICP上升→ CPP下降→CBF下降

Initial ventilator settings for Acute brain injury

- Initial Setting For Acute brain injury Patients

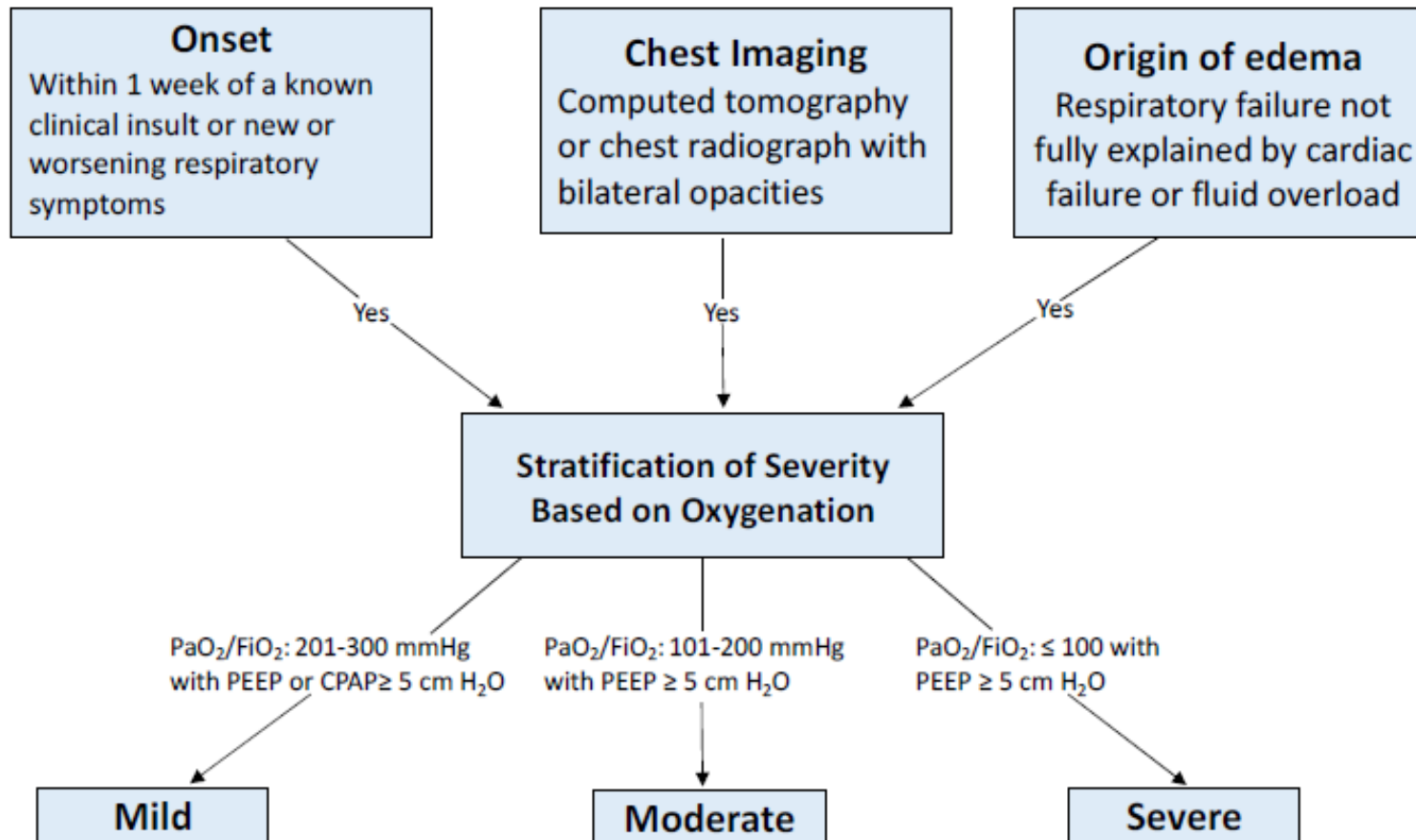
參數	設定值
Mode	VC-AC、PC-AC
VT	6-8 mL/kg
RR	12-20 bpm
Ti	0.8-1.2
PEEP	5~6 cmH2O
P plateau	<30 cmH2O
I/E	>1:3 (減少Ti, 拉長Te)
FiO ₂	FiO ₂ 1.0 initially until ABG obtained Keep PaO ₂ 80-100 mmHg (avoid hypoxemia)





ARDS - Definition

- Berlin Definition:





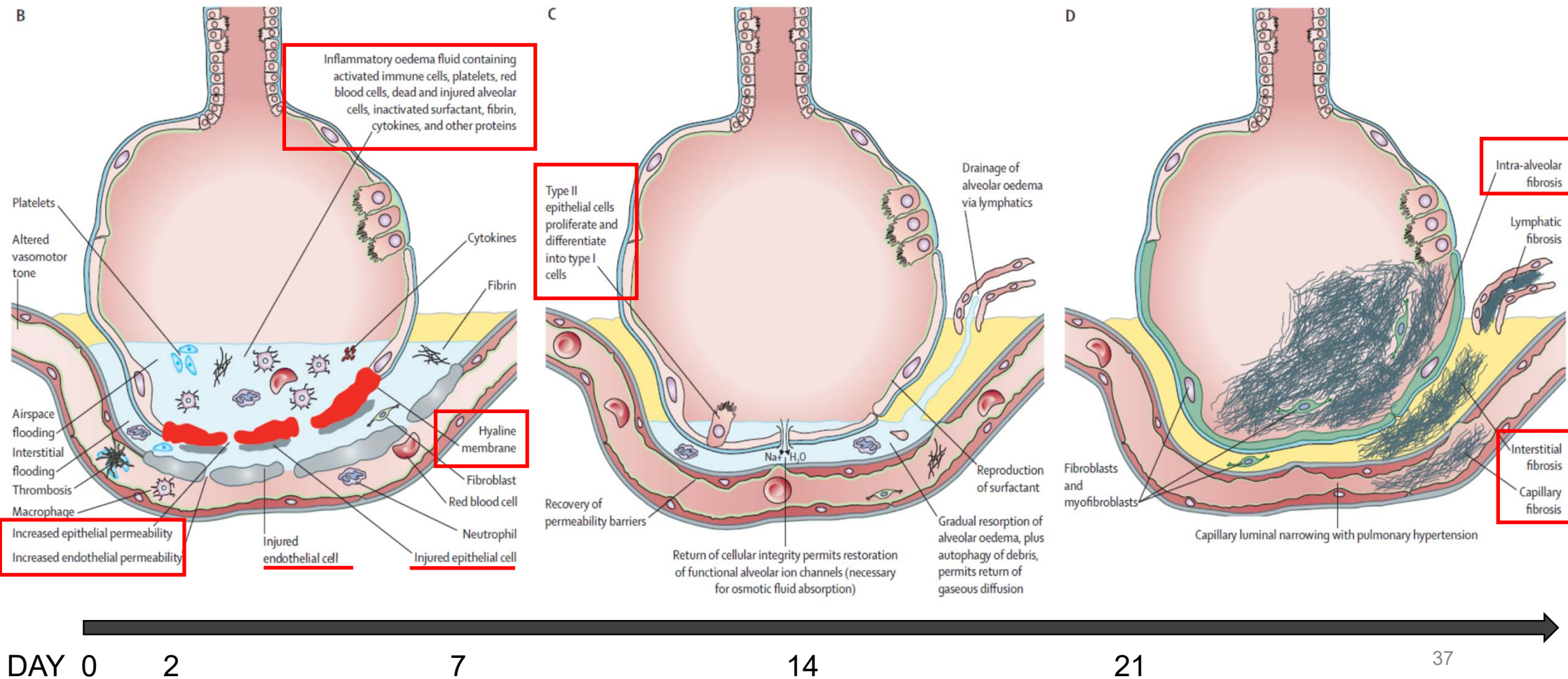
ARDS - Pathophysiology

資料來源：Acute respiratory distress syndrome *Lancet* 2016; 388: 2416-30

exudative phase

Proliferative(recovery) phase

fibrotic phase



ARDS - Ventilator strategies

Overdistention

Baby lung

Atelectrauma

Recruitable
Derecruitable

**Total atelectasis
consolidation**

Difficult-
recruitable



Inspiratory Plateau pressure
<30 cmH₂O

Ultra/Low-tidal volume
(4-6-8 ml/kg PBW)

Recruit and Optimal PEEP

Recruitment maneuver



NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

INCLUSION CRITERIA: Acute onset of

1. $PaO_2/FiO_2 \leq 300$ (corrected for altitude)
2. Bilateral (patchy, diffuse, or homogeneous) infiltrates consistent with pulmonary edema
3. No clinical evidence of left atrial hypertension

PART I: VENTILATOR SETUP AND ADJUSTMENT

1. Calculate predicted body weight (PBW)
Males = $50 + 2.3 [\text{height (inches)} - 60]$
Females = $45.5 + 2.3 [\text{height (inches)} - 60]$
2. Select any ventilator mode
3. Set ventilator settings to achieve initial $V_T = 8$ ml/kg PBW
4. Reduce V_T by 1 ml/kg at intervals ≤ 2 hours until $V_T = 6$ ml/kg PBW.
5. Set initial rate to approximate baseline minute ventilation (not > 35 bpm).
6. Adjust V_T and RR to achieve pH and plateau pressure goals below.

OXYGENATION GOAL: PaO_2 55-80 mmHg or SpO_2 88-95%

Use a minimum PEEP of 5 cm H₂O. Consider use of incremental FiO_2 /PEEP combinations such as shown below (not required) to achieve goal.

Lower PEEP/higher FiO_2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Higher PEEP/lower FiO_2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

PLATEAU PRESSURE GOAL: ≤ 30 cm H₂O

Check Pplat (0.5 second inspiratory pause), at least q 4h and after each change in PEEP or V_T .

If Pplat > 30 cm H₂O: decrease V_T by 1ml/kg steps (minimum = 4 ml/kg).

If Pplat < 25 cm H₂O and $V_T < 6$ ml/kg, increase V_T by 1 ml/kg until Pplat > 25 cm H₂O or $V_T = 6$ ml/kg.

If Pplat < 30 and breath stacking or dys-synchrony occurs: may increase V_T in 1ml/kg increments to 7 or 8 ml/kg if Pplat remains ≤ 30 cm H₂O.

pH GOAL: 7.30-7.45

Acidosis Management: (pH < 7.30)

If pH 7.15-7.30: Increase RR until pH > 7.30 or $PaCO_2 < 25$ (Maximum set RR = 35).

If pH $< 7.15:$ Increase RR to 35.

If pH remains $< 7.15,$ V_T may be increased in 1 ml/kg steps until pH > 7.15 (Pplat target of 30 may be exceeded).

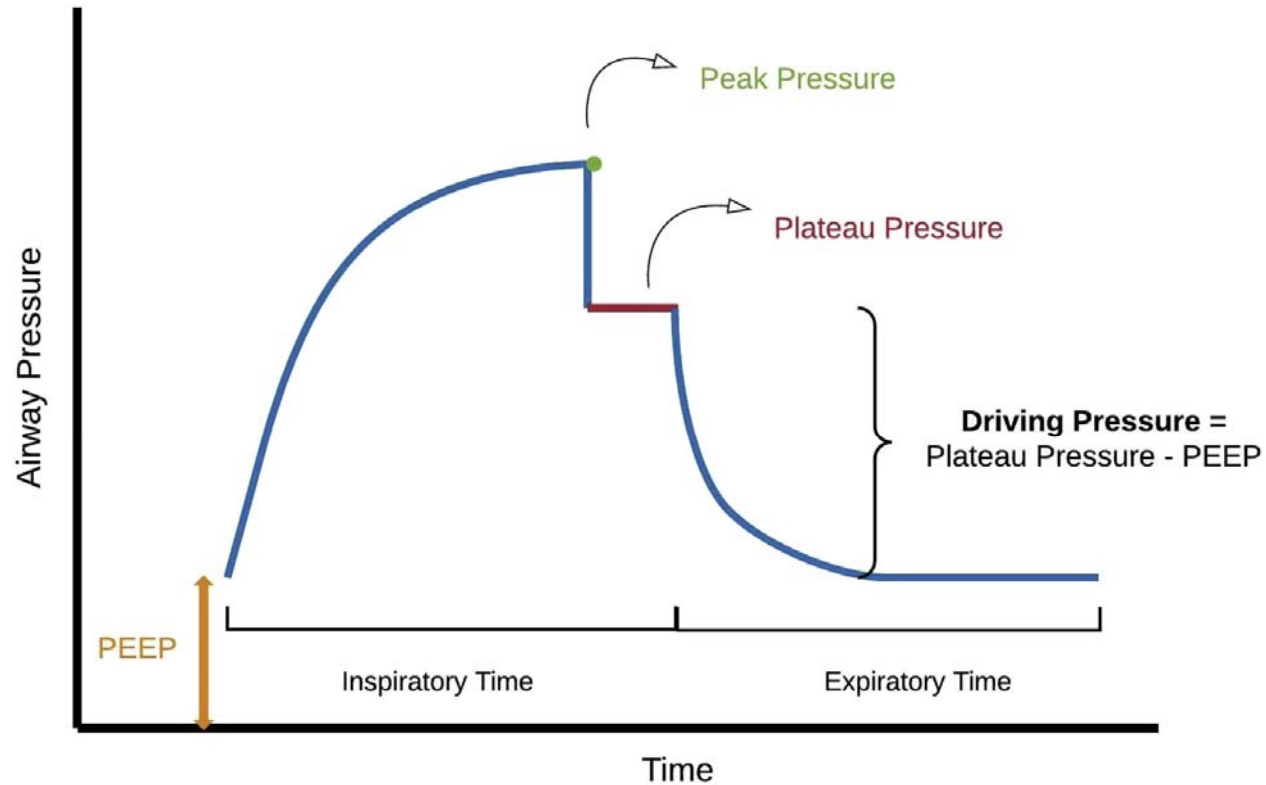
May give NaHCO₃

Alkalosis Management: (pH > 7.45) Decrease vent rate if possible.

I: E RATIO GOAL: Recommend that duration of inspiration be \leq duration of expiration.



ARDS-Risk of barotrauma



<35 cmH₂O

<30 cmH₂O

<15 cmH₂O

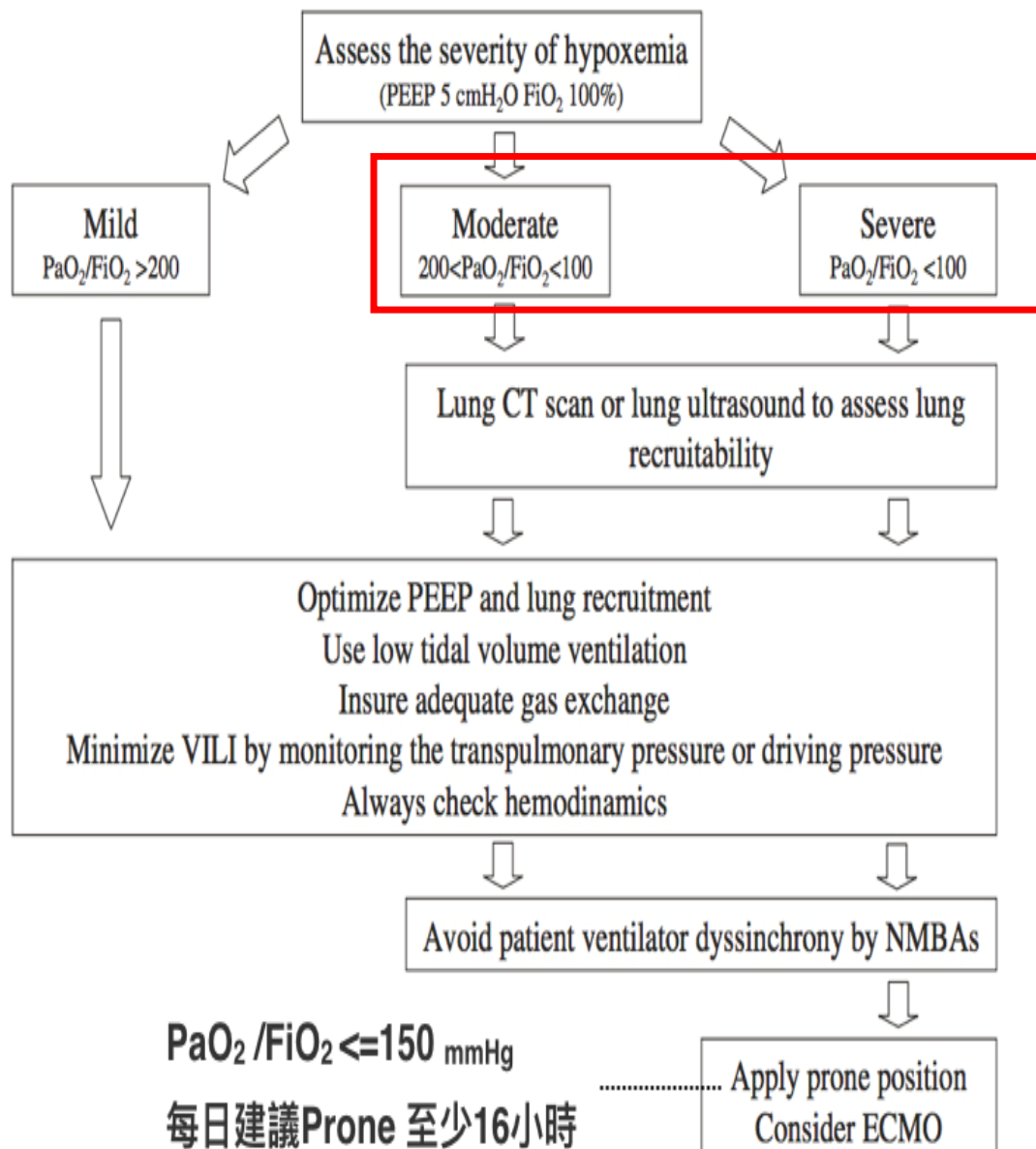
$$\text{Respiratory System Compliance} = \text{Tidal Volume} / (\text{Plateau Pressure} - \text{PEEP})$$

Initial ventilator settings for ARDS

• Initial Setting For ARDS

參數	設定值
Mode	VC-AC、PC-AC → Dual Control Mode
VT	4-6 mL/kg (Initial 8 mL/kg)
RR	<35 bpm
Ti	0.8-1.2
PEEP	5-24 cmH ₂ O ① According to ARDSnet PEEP/FiO ₂ table ② PEEP Titration ③ PV loop → Survey PMC
P plateau	<30 cmH ₂ O
Driving Pressure	<15 cmH ₂ O
I/E	1:1~1:3
FiO ₂	Goal: PaO ₂ 55-80 mmHg / SpO ₂ 88-95% FiO ₂ 1.0 initially → According to ARDSnet





- Mode: VC-AC、PC-AC → Dual Control Mode
- ① 初始設定: VT 6ml/kg (IBW)
- ② 維持範圍: VT 6-8 ml/kg (IBW)
- ③ Pplateau < 30 cmH₂O
- ④ Goal
 - a. 氧和目標: PaO₂ 55-80 mmHg 或 SpO₂ 88-95%
 - b. 通氣目標: pH > 7.25 且 CO₂ < 60 mmHg

- Analgesia and sedation
- ① Analgesia : Opioid
- ② Sedation : propofol / dexmedetomidine / Midazolam

- NMBAs
- ① 於病程早期時,短期使用
- ② 至少每小時評估病患是否達到與呼吸器同步
- ③ 24-48hr後,評估是否續用

- 若無法達目標, P/F ratio < 150, 在血液動力學穩定及深度鎮靜無自主呼吸情況下
- ① Lung recruitment
- ② Prone (> 16 hr)
- ③ ECMO

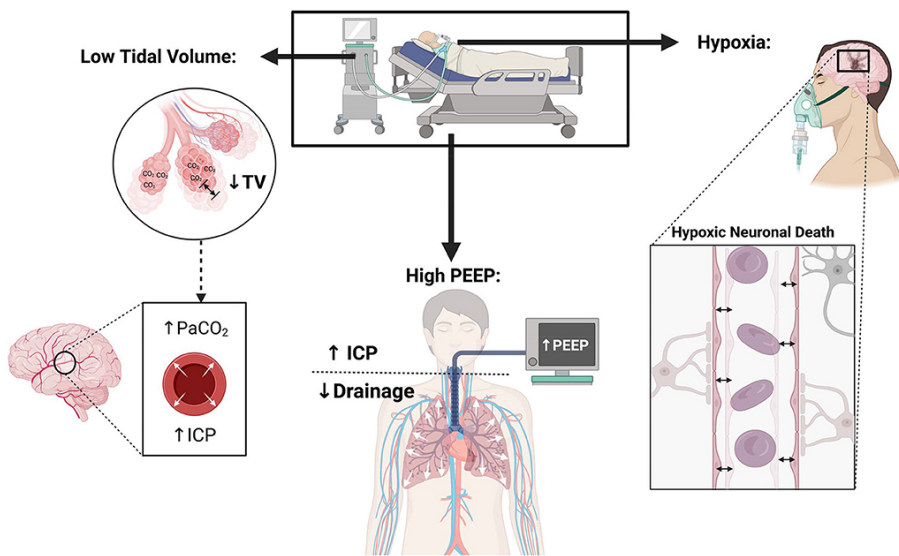
Acute brain injury with ARDS ?



Acute brain injury with ARDS

PEEP \geq 10~12 cmH₂O : Decrease CPP in Crs normal patients
 PEEP \geq 10~12 cmH₂O : Not affect CPP in Crs decrease patients
 PEEP on ICP seems to depend mainly on respiratory system compliance

Mornitor ICP、MAP、Crs
 Hypercapnia should be avoided
 Keep PH in normal range.



圖片來源 : M Humayun. Front Med (2022)

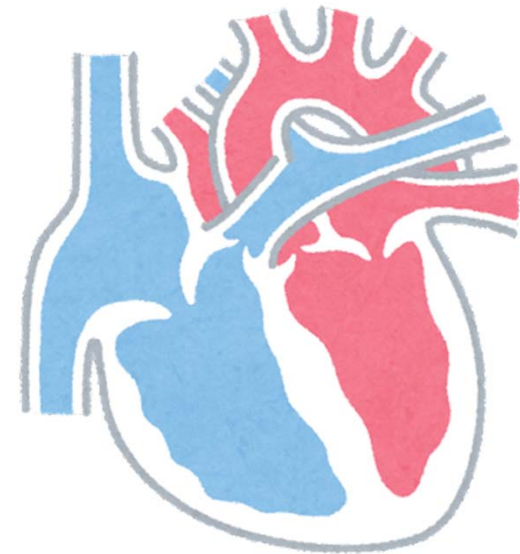
Ventilatory strategies	VT	PEEP	Ventilatory Targets
ABI 	<ul style="list-style-type: none"> • Low evidence • VT 6-9 ml/kg PBW • Pplat<30 cmH₂O 	<ul style="list-style-type: none"> • Low evidence • Could impair venous return • Hyperinflation can cause hypercapnia 	<ul style="list-style-type: none"> • PaO₂>75 mmHg • Normocapnia • PaCO₂<30 mmHg not recommended
ARDS 	<ul style="list-style-type: none"> • Strong recommendation • VT 6-ml/kg PBW • Pplat<30 cmH₂O 	<ul style="list-style-type: none"> • FIO₂/PEEP table ARDS network 	<ul style="list-style-type: none"> • PaO₂55-80 mmHg • Any PaCO₂ if pH>7.25
Final Recommendation ABI+ARDS 	<ul style="list-style-type: none"> • Protective VT • Individualize VT according to PL and DP • Increase RR to prevent hypercapnia 	<ul style="list-style-type: none"> • Individualize PEEP based on cerebral and lung compliance • Avoid hyperinflation 	<ul style="list-style-type: none"> • PaO₂>75 mmHg • Protective ventilation • Normocapnia or based on neuromonitoring and pH

Shirin K. F. Intensive Care Med (2019)

Cardiogenic Pulmonary Edema

- **Common Causes:**

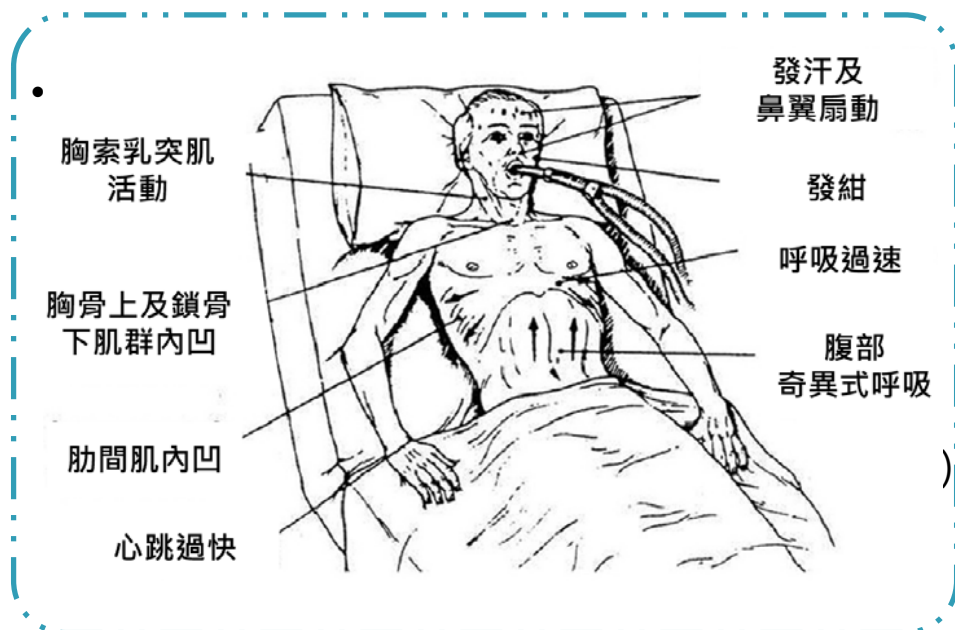
- ① Acute myocardial infarction
- ② Hypertension
- ③ Rapid heart rates with inadequate filling time
- ④ Valvular heart disease
- ⑤ Fluid overload





Ventilator Strategy -Cardiogenic Pulmonary Edema

- NPPV is now considered a first choice of ventilation to avoid invasive ventilation



- NPPV failure:
 - ① $PaO_2 < 40 \text{ mmHg}$ or $PaO_2/FiO_2 < 200 \text{ mmHg}$
 - ② $pH < 7.25$ $PaCO_2 > 60 \text{ mmHg}$
 - ③ Respiratory > 35 min
 - ④ Severe dyspnea (paradoxical abdominal motion)
 - ⑤ Hemodynamic unstable

圖片來源：Talwar D.(2016). J Assoc Chest Physicians



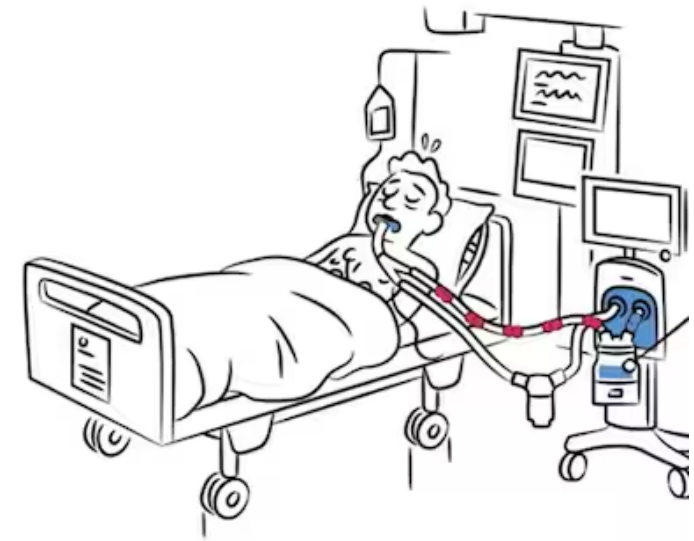
PEEP in LV dysfunction

- 機械通氣期間的氣道正壓或吐氣末正壓 (Positive end expiratory pressure, PEEP) 可使胸腔內壓力升高(Intrathoracic pressure) , 對左心過度負荷患者有助益
 - a) 透過降低右心前負荷(Venous return ↓)
 - b) 透過增加FRC→增加肺血管阻力→ ↑ 右心前負荷→ 降低左心前負荷
 - c) 胸腔內壓力升高(Intrathoracic pressure)→ 降低左心後負荷
→來改善心輸出量
 - d) 通過在肺泡和肺間質之間的介面施加壓力 →來平衡靜水壓 並 減少血管外肺水。
 - e) 保持肺泡壓力以防止肺泡塌陷

Initial ventilator settings for Cardiogenic Pulmonary Edema

- Initial Setting For Cardiogenic Pulmonary Edema

參數	設定值
Mode	PC/AC (Flow to meet patient' s demand)
VT	6-10 mL/kg
RR	10-12 bpm
Ti	1.0-1.2
PEEP	5~10 cmH2O (Initial 8 cmH2O)
P plateau	<30 cmH2O
I/E	1:4
FiO ₂	Keep SpO ₂ >90-92% or PaO ₂ 55-75 mmHg



Initial ventilator settings for Post-operative patients

適當設定呼吸器參數

- Predicted body weight (PBW)
 - 公式 $PBW = (\text{Height}_{(m)})^2 \times 22$
- Minute Ventilation (V_E)
 - Minute Ventilation = $V_T \times RR$
 - 公式1 Male = $4 \times BSA$ / Female = $3.5 \times BSA$
 - 公式2 $PBW \times 100(\text{ml/kg}) \div 1000$
- Tidal volume (V_T)
 - Adult : 8 mL/kg (PBW)
- Respiratory rate (RR)
 - 12~20 bpm



資料來源 : Pilbeam's Mechanical Ventilation: Physiological and Clinical Applications 7/E 2020

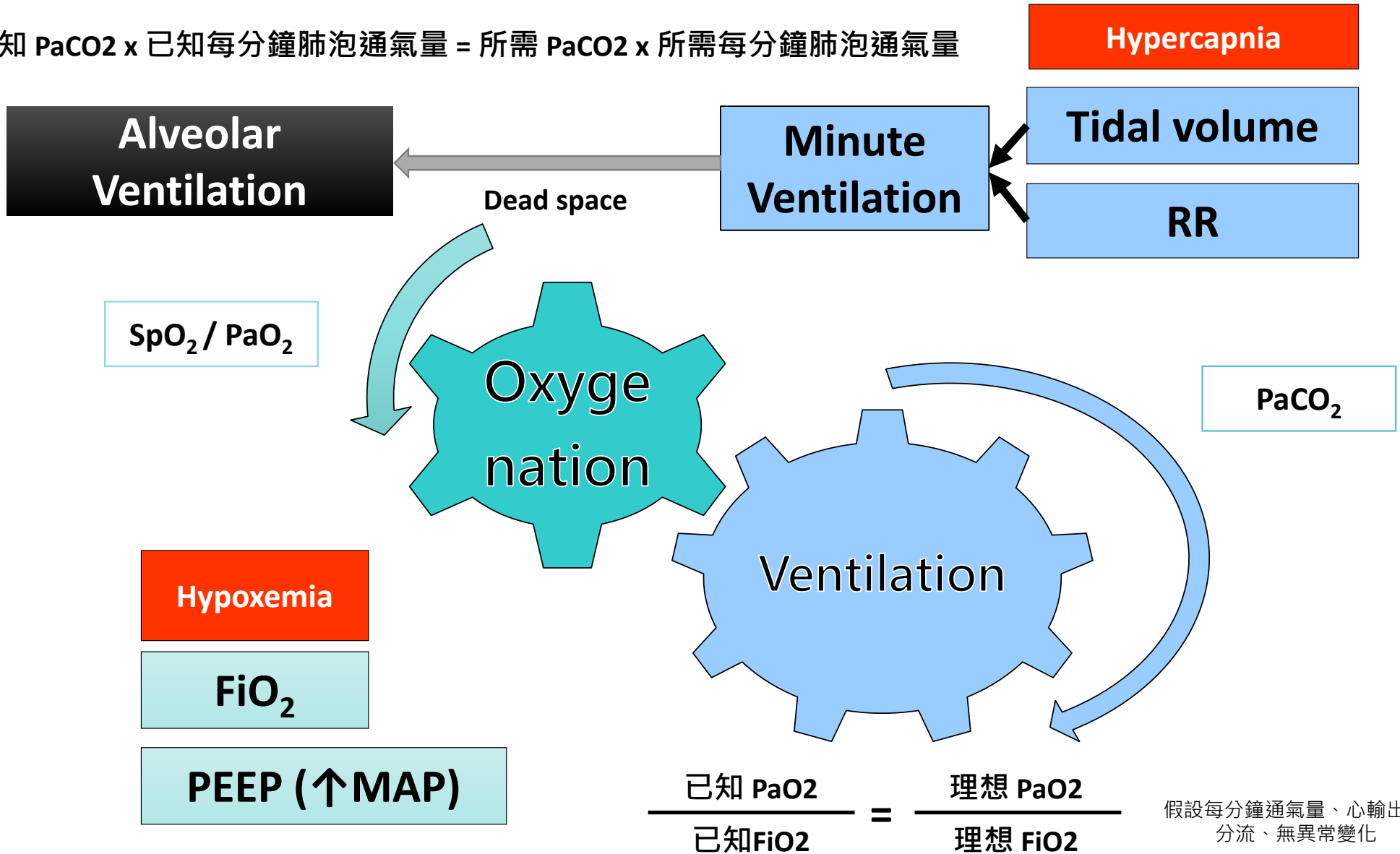
適當設定呼吸器參數

- Trigger sensitivity: Flow trigger 1-2 lpm
- Inspiratory time (Ti)
 - To achieve Ti 0.8~1.2 sec
- Positive end-expiratory pressure (PEEP)
 - Initial : 5-6 cmH₂O
 - BMI > 30 or $FiO_2 > 60$ → set 8cmH₂O
- FiO_2 – Adjust FiO_2 to achieve $SpO_2 > 92\%$
- Alarm and limit

資料來源 : Pilbeam's Mechanical Ventilation: Physiological and Clinical Applications 7/E 2020

- 所有特定疾病或病史請依該疾病進行設定(EX: Obstructive lung disease)

已知 PaCO₂ x 已知每分鐘肺泡通氣量 = 所需 PaCO₂ x 所需每分鐘肺泡通氣量



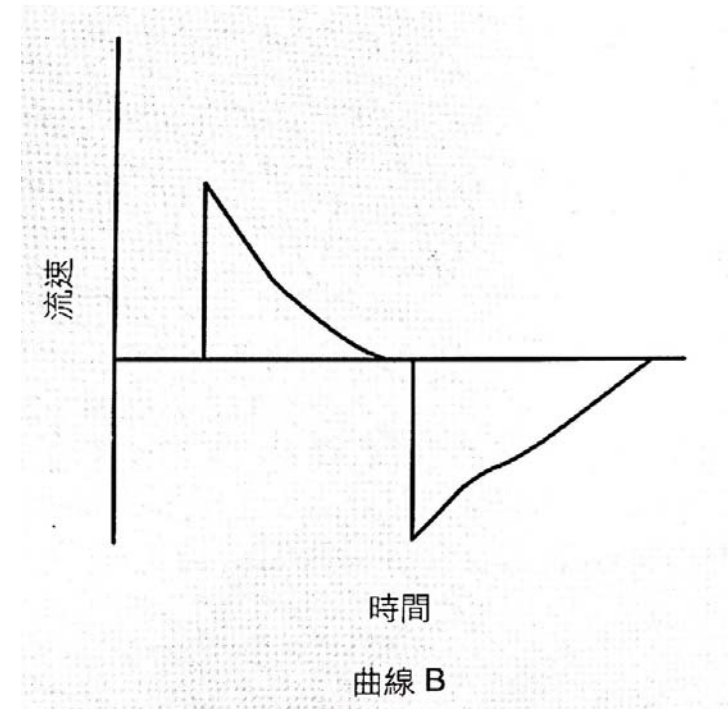
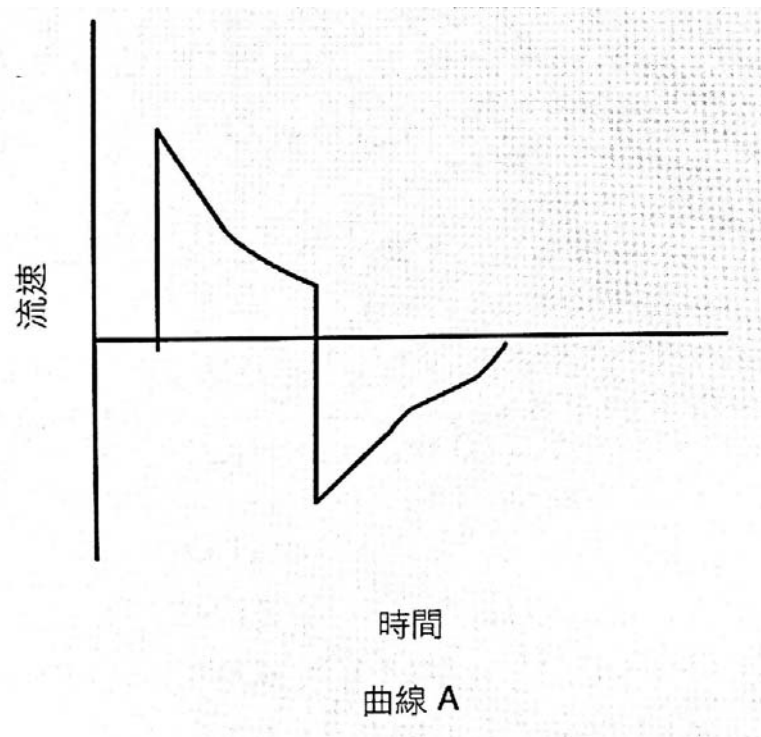


壓力通氣模式下之通氣目標調整

75公斤病人

PC-AC / RR 12 bpm / PEEP 6cmH₂O / 壓力設定 ΔP 14 cmH₂O / Ti 0.7sec

ABG: 7.30 / PaCO₂ 50mmHg / HCO₃⁻ 23mEq/L



Lung characteristics – Compliance & Resistance

Increased airway resistance	Reduced compliance
<p>Tube (small diameter, sputum retention) Laryngeal swelling / edema Central airways Tracheostomy malposition Sputum plug Corpus alienum Tracheomalacia or tracheal stenosis</p> <p>Small airways Asthma and COPD (obstructive) ARDS Tumors surrounding / compression airway Retained secretion</p>	<p>Chest wall Edema Elevated abdominal pressure Pleural fluid and ascites Obesity</p> <p>Lung Intrinsic positive end-expiratory pressure Alveolar filling (edema, pus, and collapse) Pneumonia Interstitial lung disease and fibrosis</p>



使用侵襲性呼吸器病人之初始設定及照護- 錯誤與風險

- ① 呼吸器設定不當，產生呼吸性酸/鹼血症或高/低血氧等併發症
- ② 病人呼吸與呼吸器通氣不同步，可能會增加呼吸功
- ③ 呼吸道濕度不足，痰液排除困難，可能會增加呼吸道阻力
- ④ 非預期的心血管效應



實際操作-工作坊

個案情境練習-(1)

Dx. Left lung abscesses with left pleural empyema

60歲呂先生

Hx: DM, CKD

發燒及左胸痛至本院急診，胸部電腦斷層檢查為左肺膿胸，行左側肋膜積液引流穿刺術，收入9C病房。五日後手術，術式 VATS decortication + VATS wedge resection of LLL術後帶氣管內管轉入SICU繼續照護。

◎ 情境任務

- ① 完成病人轉入事前準備
- ② 完成病人轉入後呼吸器初始設定
- ③ 完成臨床評估
- ④ 承接此病人呼吸器初始設定需要那些資訊？請取得並說明
- ⑤ 說出此病人呼吸器與相關照護目標

◎ 討論

- ① 您認為執行此任務可能會遇到甚麼困難？如何處理？為什麼？有甚麼預防策略？

個案情境練習-(2)

Dx. COVID-19 infection with pneumonia

81歲周女士

Hx: HTN. dementia. RA

確診Covid-19呼吸喘、發燒由診所轉入ER，於ER因低血氧性呼吸衰竭使用HFNC，收入11B病房。HFNC使用九天後，因低血氧性呼吸衰竭準備放置氣管內管並使用呼吸器。

◎ 情境任務

- ① 說出此病人HFNC下低血氧性呼吸衰竭的插管適應症
- ② 完成呼吸器事前準備
- ③ 說明插管當下RT的任務與角色
- ④ 完成病人完成插管後呼吸器初始設定
- ⑤ 完成臨床評估
- ⑥ 承接此病人呼吸器初始設定需要那些資訊？請取得並說明
- ⑦ 說出此病人呼吸器與相關照護目標

◎ 討論

- ① 您認為執行此任務可能會遇到甚麼困難？如何處理？為什麼？有甚麼預防策略？

個案情境練習-(3)

Dx. COVID-19 infection with pneumonia

81歲周女士

Hx: HTN. dementia. RA

病人放置氣管內管使用呼吸器後，持續低血氧，胸腔影像顯示雙側浸潤增加，動脈血液氣體分析如呼吸照護紀錄單張，請給予適當的呼吸器設定調整。

◎ 情境任務

- ① 說出此病人符合ARDS的條件
- ② 完成病人適當的呼吸器初始設定
- ③ 完成臨床評估
- ④ 承接此病人呼吸器設定需要那些資訊？請取得並說明
- ⑤ 說出此病人呼吸器與相關照護目標

◎ 討論

- ① 您認為執行此任務可能會遇到甚麼困難？如何處理？為什麼？有甚麼預防策略？

個案情境練習-(4)

Dx. Right basal ganglion ICH, s/p

45歲張先生

Hx: HTN. DM

開車到一半感身體不適，將車停路邊後，突出現左側肢體沒力、口齒不清、嘔吐，BrainCT: Right basal ganglion ICH. 行手術術式: Right craniotomy for ICH removal 術後放置氣管內管入ICU。

◎ 情境任務

- ① 完成病人轉入事前準備
- ② 完成病人轉入後呼吸器初始設定
- ③ 完成臨床評估
- ④ 承接此病人呼吸器初始設定需要那些資訊？請取得並說明
- ⑤ 說出此病人呼吸器與相關照護目標

◎ 討論

- ① 您認為執行此任務可能會遇到甚麼困難？如何處理？為什麼？有甚麼預防策略？

Thank you for your attention



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讓我們手牽手

共同精進
呼吸治療師
教學品質