Special Consideration in Mechanical Ventilation Patient With COVID-19

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COVID-19 di Indonesia 01-05-2020

JOHNS HOPKINS UNIVERSITY & MEDICINE | CORONAVIRUS RESOURCE CENTER

Home | Maps & Trends | Testing | News & Information | COVID-19 Basics | Videos & Live Events

World Map | NEW U.S. Map | Critical Trends

COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)

Total Confirmed
3,259,167

Confirmed Cases by Country/Region/Sovereignty

12,877 Poland
12,481 United Arab Emirates
12,240 Romania
10,774 Korea, South
10,406 Ukraine
10,118 Indonesia
9,356 Denmark
9,009 Serbia
8,488 Philippines
7,738 Norway
7,689 Czechia
7,667 Bangladesh
6,972 Dominican Republic

Admin0 | Admin1 | Admin2

Last Updated at (M/D/YYYY)
5/1/2020, 2:32:31 PM

Indonesia

Coronavirus Cases:
10,118

Death:
792

Recovered:
1,522

Cumulative Confirmed Cases | Active Cases | Incidence Rate | Case-Fatality Ratio | Testing Rate | Hospitalization Rate

187
countries/regions

Lancet Inf Dis Article: Here. Mobile Version: Here.
Lead by JHU CSSE. Automation Support: Esri Living Atlas team and JHU APL. Contact US. FAQ.

Data sources: WHO, CDC, ECDC, NHC, DXY, 1point3acres, Worldometers.info, BNO, the COVID Tracking

Total Deaths
233,439

27,967 deaths
Italy

26,771 deaths
United Kingdom

24,543 deaths
Spain

24,376 deaths
France

18,069 deaths
New York City **New York** US

7,594 deaths
Belgium

Deaths | Recovered

Total Test Results in US
6,231,182

900,636 tested
New York US

625,337 tested
California US

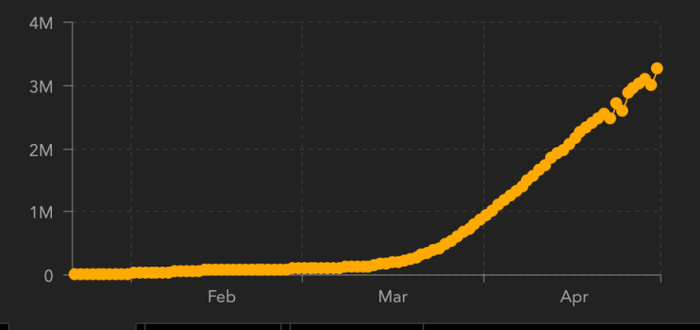
382,405 tested
Florida US

314,790 tested
Texas US

275,647 tested
Massachusetts US

269,867 tested
Illinois US

US total tests

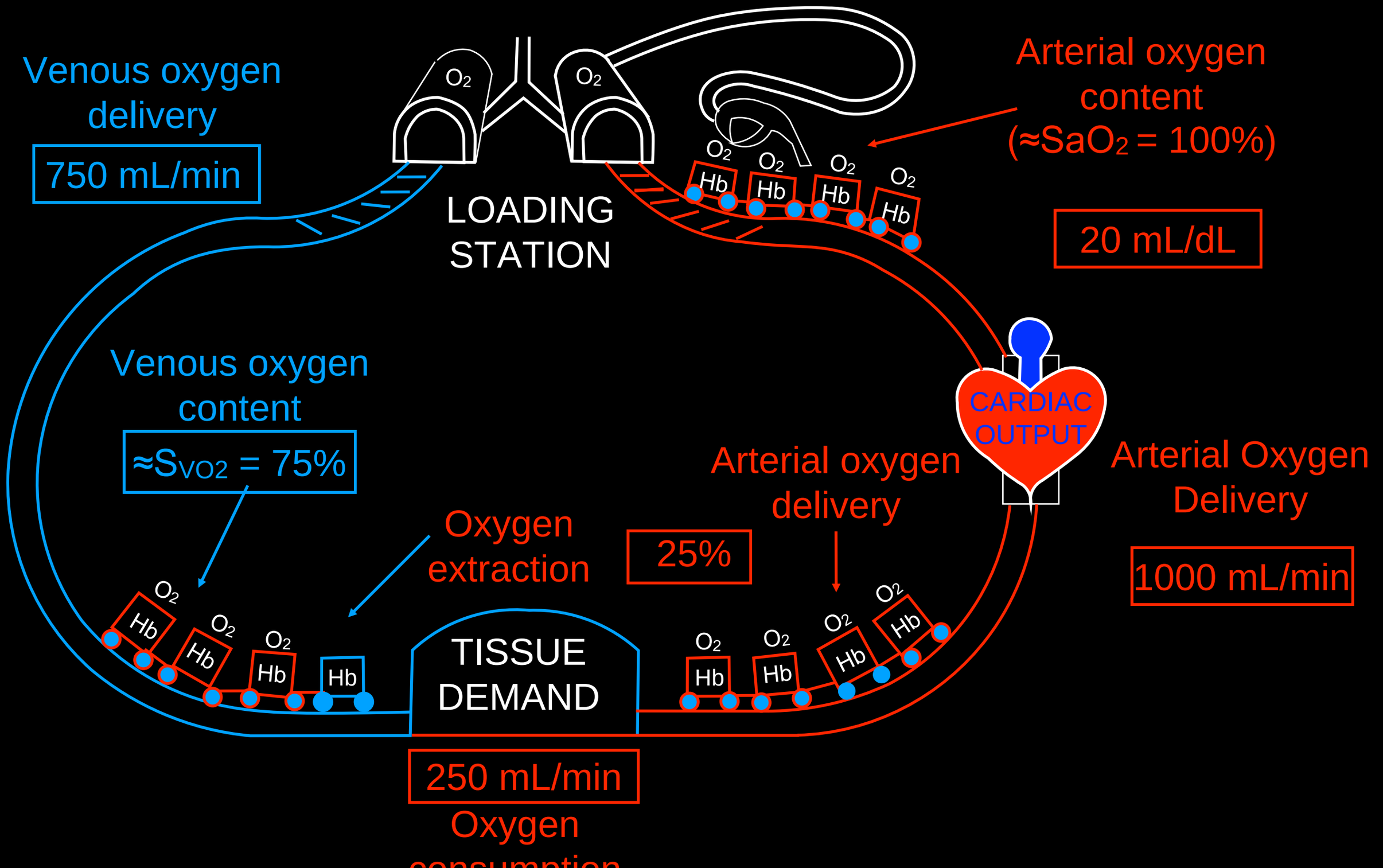


Confirmed | Logarithmic | Daily Cases

Screenshot

Pengiriman oksigen global (DO_2)

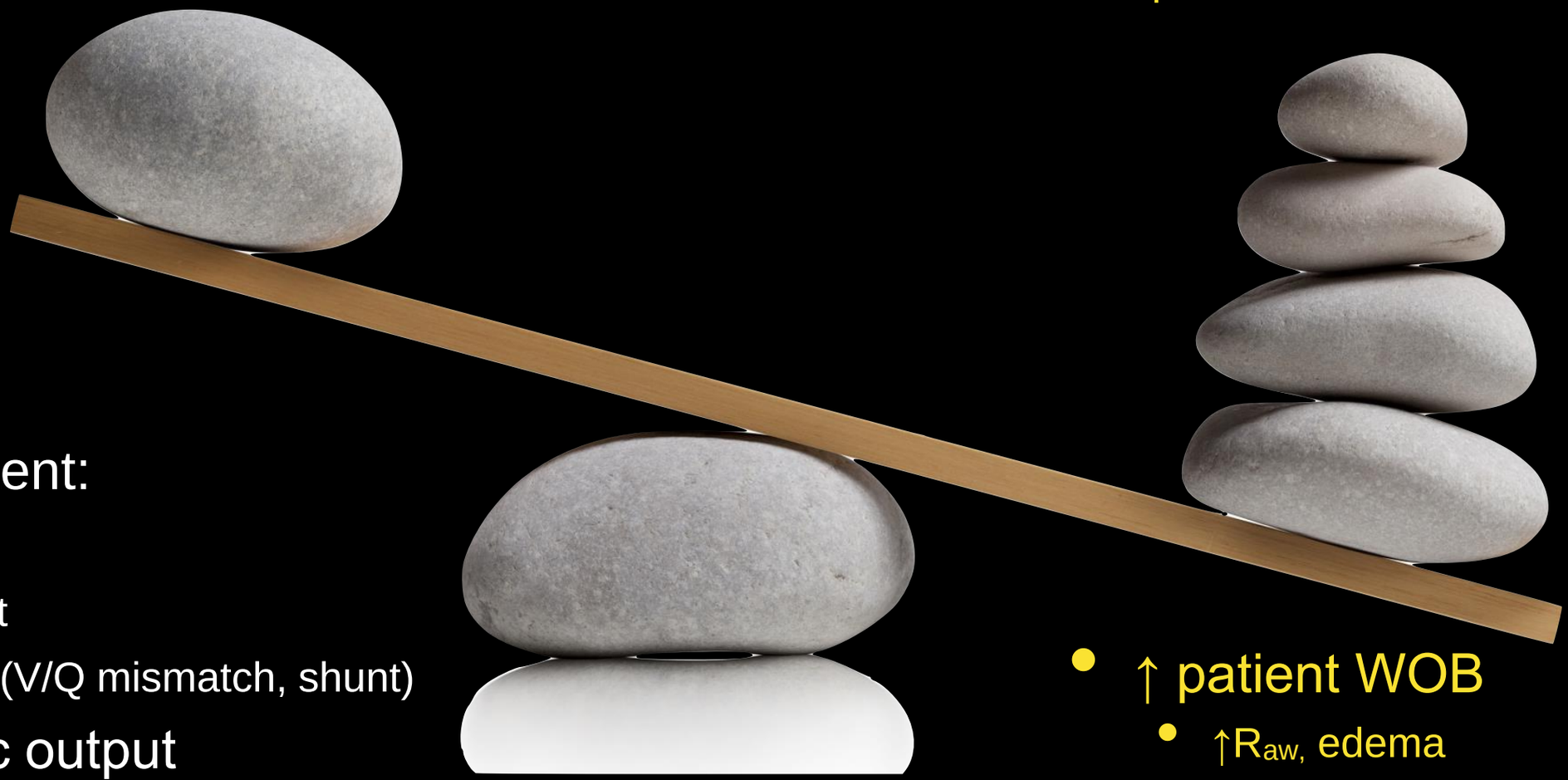
$DO_2 = CO \times \{(Hb \times SaO2 \times 1{,}36) + (pO2 \times 0.003)\}$



Menjaga Oxygen Balance

↓ O_2 Delivery

↑ O_2 Demand



- ↓O_2 content:
  - ↓ Hgb
  - ↓ O_2 sat
  - ↓ PaO_2 (V/Q mismatch, shunt)
- ↓ cardiac output
  - ↑preload
  - ↑afterload
  - ↓contractility

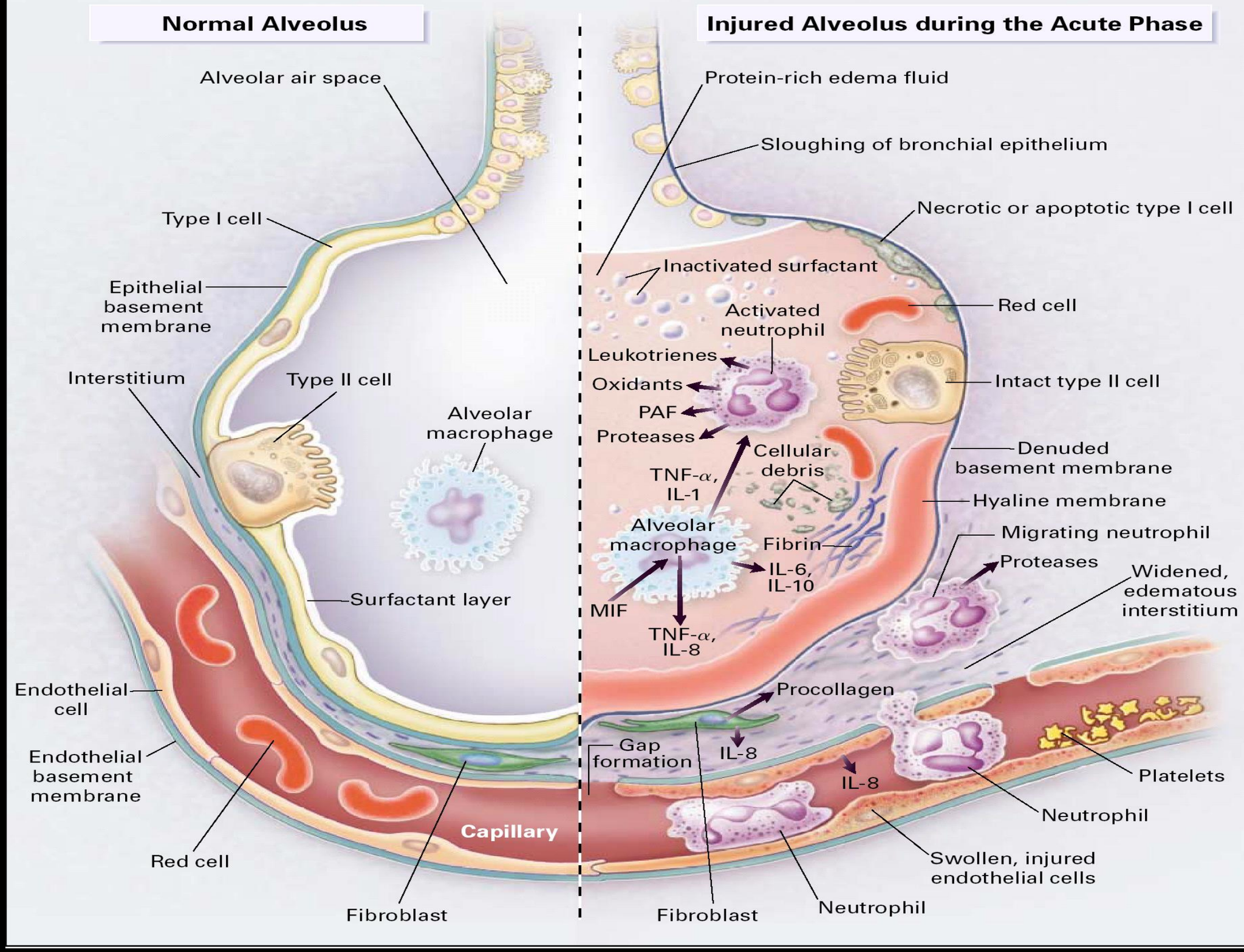
- ↑ patient WOB
  - ↑$R_{aw,}$ edema
  - loss of PPV & PEEP
  - secretion
- ↑ metabolism:
  - fever, sepsis, exercise

MV adalah tindakan yg supportif
Bukan terapeutik
“Just to buy time”

Tujuan mechanical ventilation

- Memperbaiki oksigenasi
- Mencapai ventilasi dan eliminasi CO_2 yang adekuat
- Meringankan gangguan pernapasan - melepaskan beban kerja otot pernapasan
- Mencegah penyulit/cedera pada sistim pernapasan
  - Ventilator induced lung injury (VILI)
  - Ventilator associated pneumonia (VAP)

ARDS Klasik

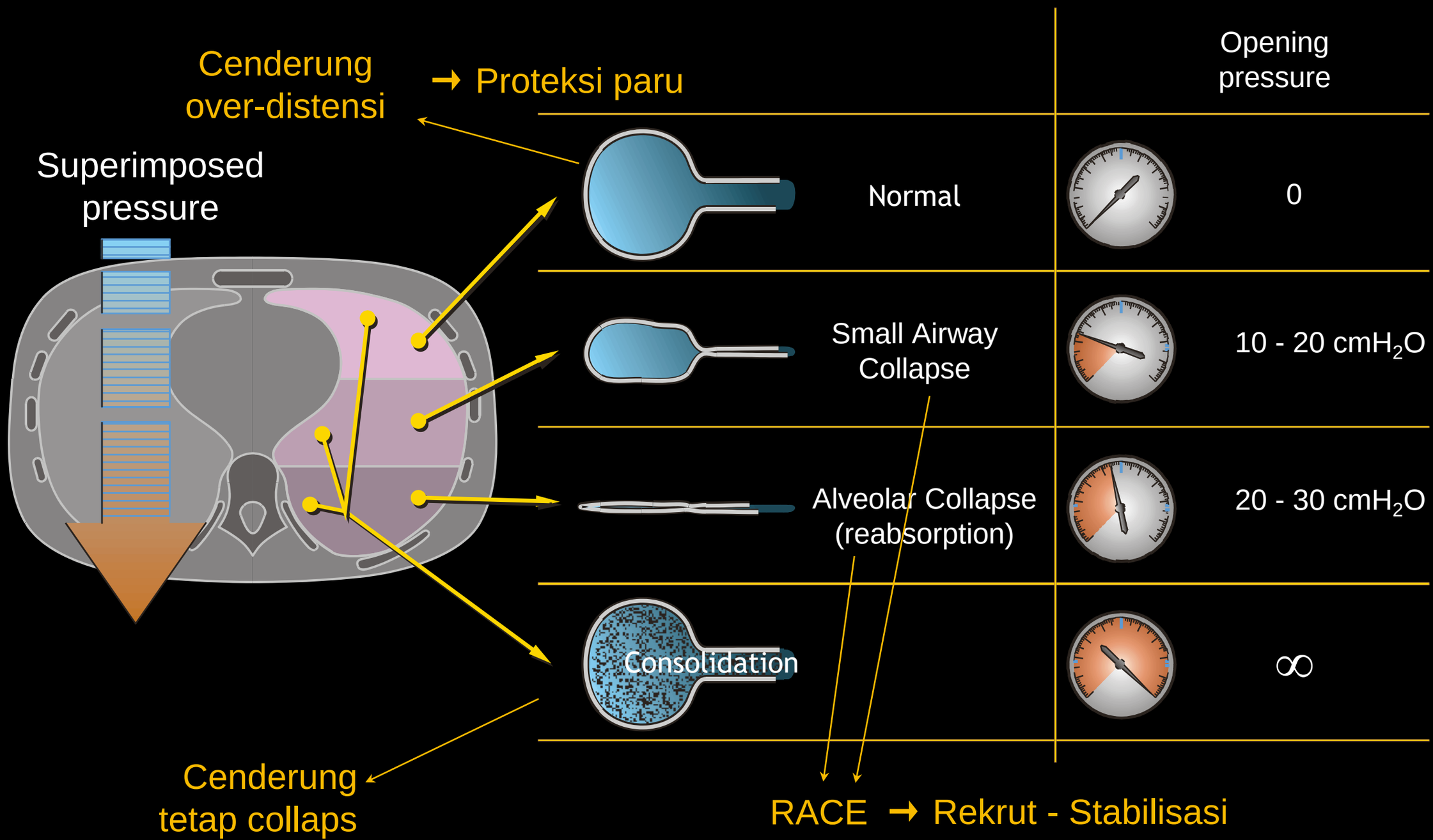


The Normal Alveolus

Injured Alveolus in the Acute Phase of ARDS

Ware LB, Matthay MA. *N Engl J Med* 2000;342:1334-1349

Masalah-masalah pemberian ventilasi mekanis pada ALI-ARDS



L. Gattinoni, 2005

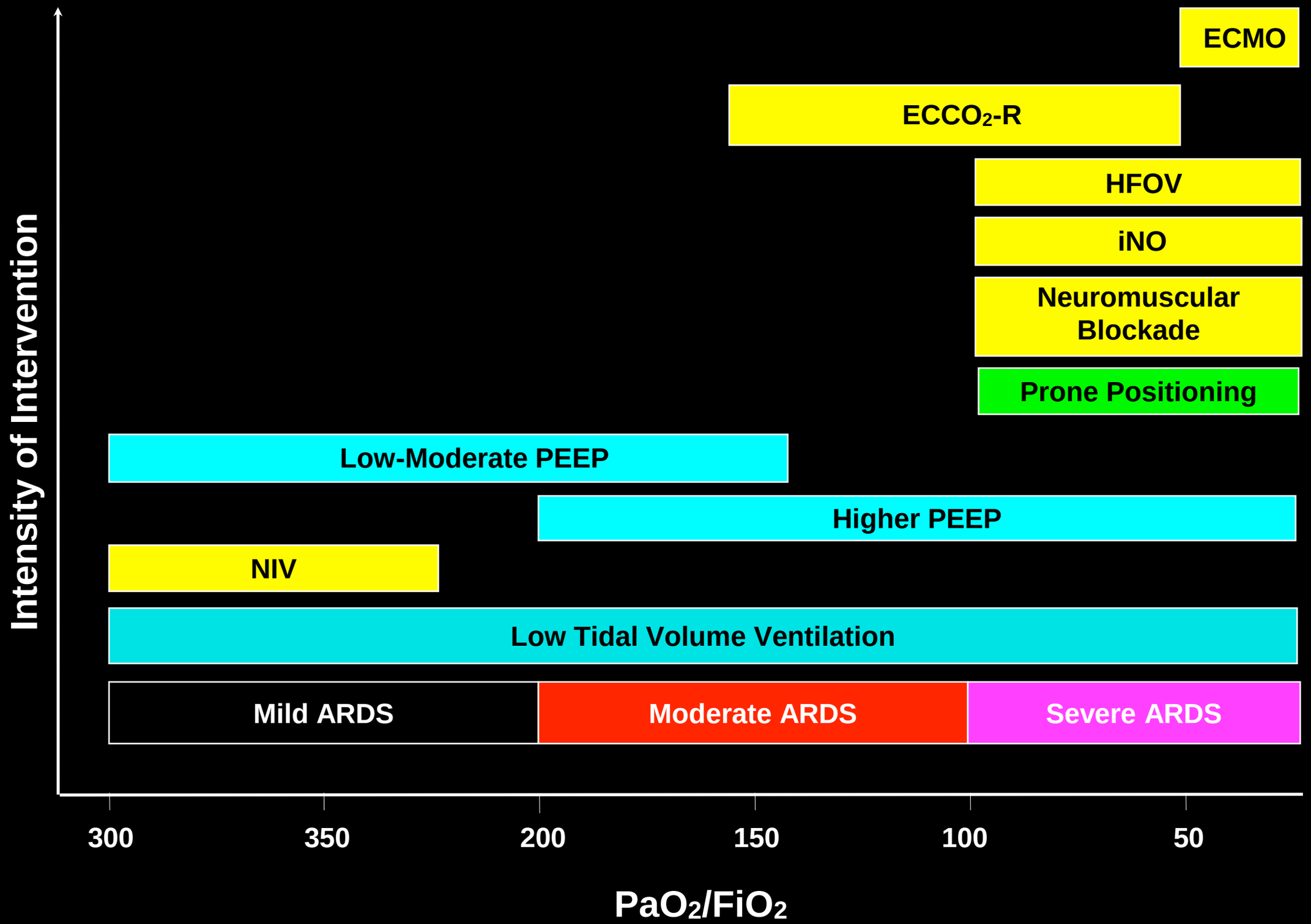
Strategi ventilasi mekanis pada ARDS

- Gunakan PEEP → menurunkan intrapulmonary shunting
- Tidal volume lebih kecil (4 - 6 ml/kg PBW) → mencegah overdistensi (VILI)
- Pplat < 30 cmH_2O → mencegah overdistensi
- Menerima kenaikan frekwensi (< 35 napas/menit)
- Menerima hypercapnia bila perlu
- Minimalisasi FiO_2 < 0.6 → menurunkan resiko keracunan oksigen
- Driving pressure sekitar 14 cmH_2O (Amato)
- Penggunaan obat pelemas otot (Papazian - ACURASYS Study, 2010)
- Posisi tengkurap (Guérin - PROSEVA Study, 2013)

Lung Protective Strategies

The ARDS Network. *N Engl J Med* 2000;342:1301-1308

ARDS clinical managements implications of Berlin Definition



Pandemi COVID-19

Summary of recommendations on the initial management of hypoxic COVID-19 patients

COVID-19 with hypoxia

Indication for endotracheal intubation?

Yes

- ✔ **DO IT:** Endotracheal intubation
- ✔ **DO IT:** Expert in airway to intubate
- ✔ **DO IT:** Use N-95/FFP-2 or equivalent and other PPE/infection control precautions
- ✔ **DO IT:** Minimize staff in the room
- ⚠ **CONSIDER:** if available Video-laryngoscope

No

Tolerating supplemental oxygen?

Yes

- ✔ **DO IT:** Monitor closely for worsening
- ✔ **DO IT:** Target SpO2 92% to 96%
- ✔ **DO IT:** Appropriate infection control precautions
- ⛔ **DO NOT:** Delay intubation if worsening

No

⚠ CONSIDER: HFNC

Tolerating HFNC

Not tolerating HFNC or HFNC is not available

Indication for endotracheal intubation?

Yes

No

- ⚠ **CONSIDER:** a trial of NIPPV
- ✔ **DO IT:** Monitor closely short intervals
- ⛔ **DO NOT:** Delay intubation if worsening

Note: N-95/FFP-2 are facial masks

HFNC = high-flow nasal cannula
NIPPV = noninvasive positive-pressure ventilation
PPE = personal protective equipment
SpO2 = peripheral capillary oxygen saturation

Summary of recommendations on the management of patients with COVID-19 and ARDS

COVID-19 with mild ARDS

DO:
Vt 4-8 ml/kg and P_{plat} < 30 cm H_2O

DO:
Investigate for bacterial infection

DO:
Target SpO2 92% - 96%

CONSIDER:
Conservative fluid strategy

CONSIDER:
Empiric antibiotics

UNCERTAIN:
Systemic corticosteroids

COVID-19 with mod to severe ARDS

CONSIDER:
Higher PEEP

CONSIDER:
NMBA boluses to facilitate ventilation targets

CONSIDER: if PEEP responsive
Traditional recruitment maneuvers

CONSIDER:
Prone ventilation 12 -16 h

CONSIDER: if proning, high P_{plt}, asynchrony
NMBA infusion for 24 h

DON'T DO:
Staircase recruitment maneuvers

CONSIDER:
Short course of systemic corticosteroids

UNCERTAIN:
Antivirals, chloroquine, anti-IL6

Rescue/adjunctive therapy

UNCERTAIN:
Antivirals, chloroquine, anti-IL6

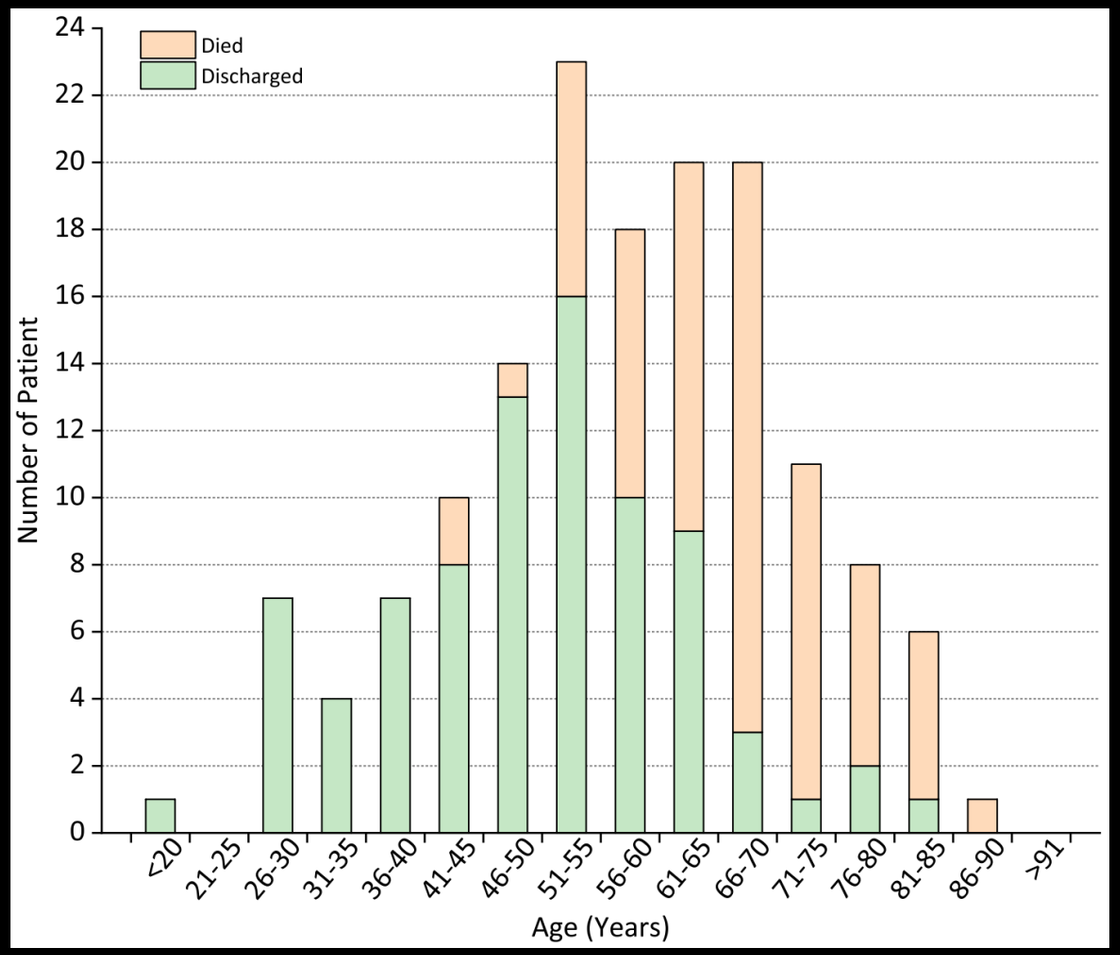
CONSIDER: if proning, high P_{plt}, asynchrony
NMBA infusion for 24 h

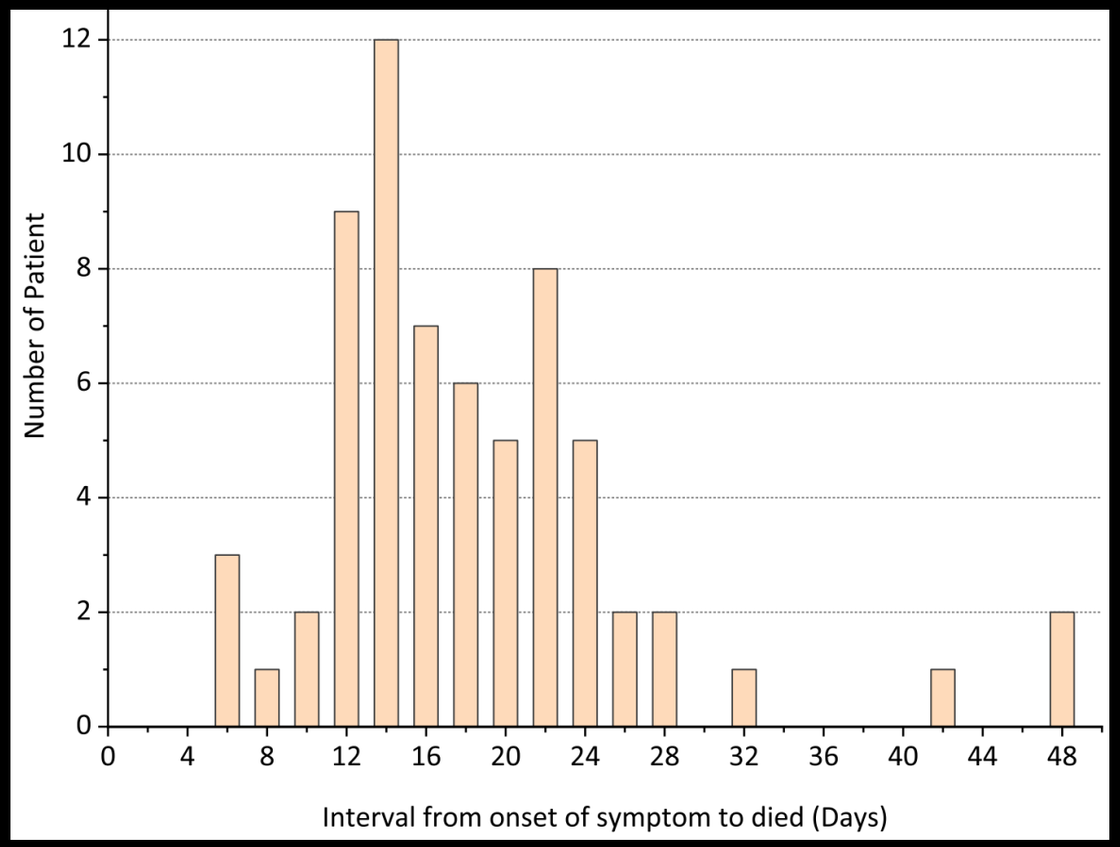
CONSIDER:
Prone ventilation 12 -16 h

CONSIDER: STOP if no quick response
A trial of inhaled nitric oxide

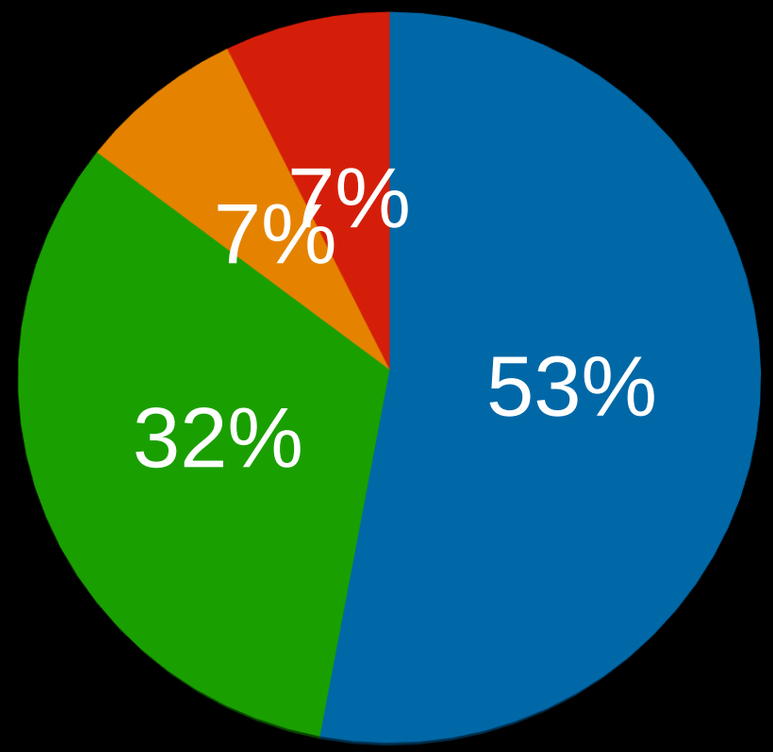
CONSIDER: follow local criteria for ECMO
V-V ECMO or referral to ECMO center

Mod = moderate
ARDS = adult respiratory distress syndrome
P_{plat} = plateau pressure
SpO2 = peripheral capillary oxygen saturation
PEEP = positive end-expiratory pressure
NMBA = neuromuscular blocking agents
ECMO = extracorporeal membrane oxygenation





Summary of the cause of death of 68 died patients with confrmed COVID-19



- Respiratory Failure
- Resp Failure with Myocardial Damage/HF
- Myocardial Damage/HF
- Unknown

Ruan Q, et al. Intensive Care Med 2020
https://doi.org/10.1007/s00134-020-05991-x

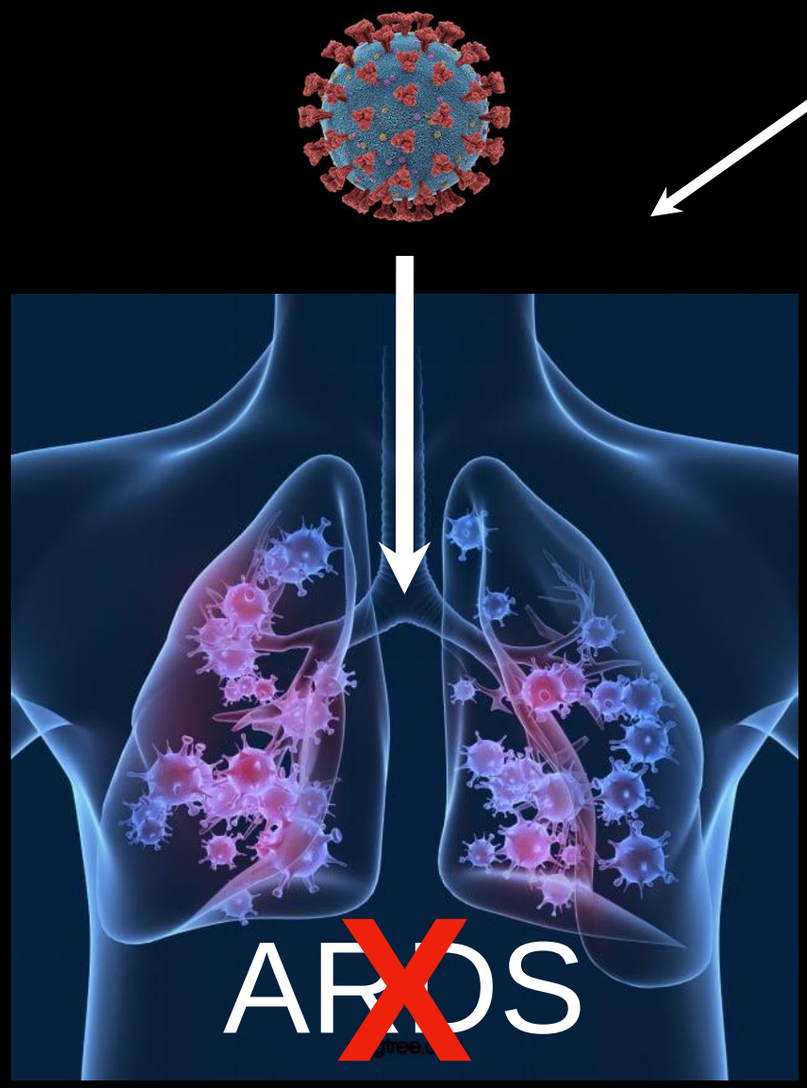
United Kingdom's Intensive Care National Audit and Research Center (ICNARC) on April 10, 2020

3883 pasien confirmed COVID-19 dirawat di ICU di England, Wales, atau Northern Ireland:

- 871 meninggal
- 818 sembuh keluar dari ICU
- 2194 pasien masih dirawat di ICU
- 1053 pasien memerlukan MV, mortalitas 66.3%
- 444 pasien memerlukan basic respiratory support, mortalitas 19.4%
- Pasien dirawat di ICU dengan MV karena viral pneumonia dari 2017 sampai 2019, mortalitas 35.1%

https://www.medscape.com/viewarticle/928605

SARS-COV-2



Mengapa mortalitas tinggi?

?

Masuk pada stadium terminal?
Mutasi virus?
Patogenesis berbeda?
Dll.

Karakteristik khas CT pada COVID-19

Gambar:

1. Gambar 1, Gambar 2: spot-spot ground glass opacities (GGO);
2. Gambar 3: nodul dan eksudasi yang tidak merata;
3. Gambar 4, Gambar 5: lesi gabungan multifokal;
4. Gambar 6: lesi gabungan menyebar, "paru-paru putih"

Liang, T. (eds.). Buku Pegangan Pencegahan dan Penatalaksanaan COVID-19. Alibaba Cloud

Bronchoscopy COVID-19

Tampilan bronkoskopik dari hiperemia mukosa bronkus yang meluas, pembengkakan, sekresi seperti mucus di lumen, dan dahak seperti jeli yang menghalangi jalan napas pada pasien dalam kondisi kritis

Liang, T. (eds.). Buku Pegangan Pencegahan dan Penatalaksanaan COVID-19 . Alibaba Cloud

Intensive Care Med
https://doi.org/10.1007/s00134-020-06033-2

EDITORIAL

COVID-19 pneumonia: different respiratory treatments for different phenotypes?

Luciano Gattinoni[1*], Davide Chiumello[2], Pietro Caironi[3,4], Mattia Busana[1], Federica Romitti[1], Luca Brazzi[5] and Luigi Camporota[6]

The presentation in ED depend on the interaction between 3 factors:

1. the severity of the infection, the host response, physiological reserve and comorbidities;
2. the ventilatory responsiveness to hypoxemia;
3. the time elapsed between the onset of the disease and the observation in the hospital.

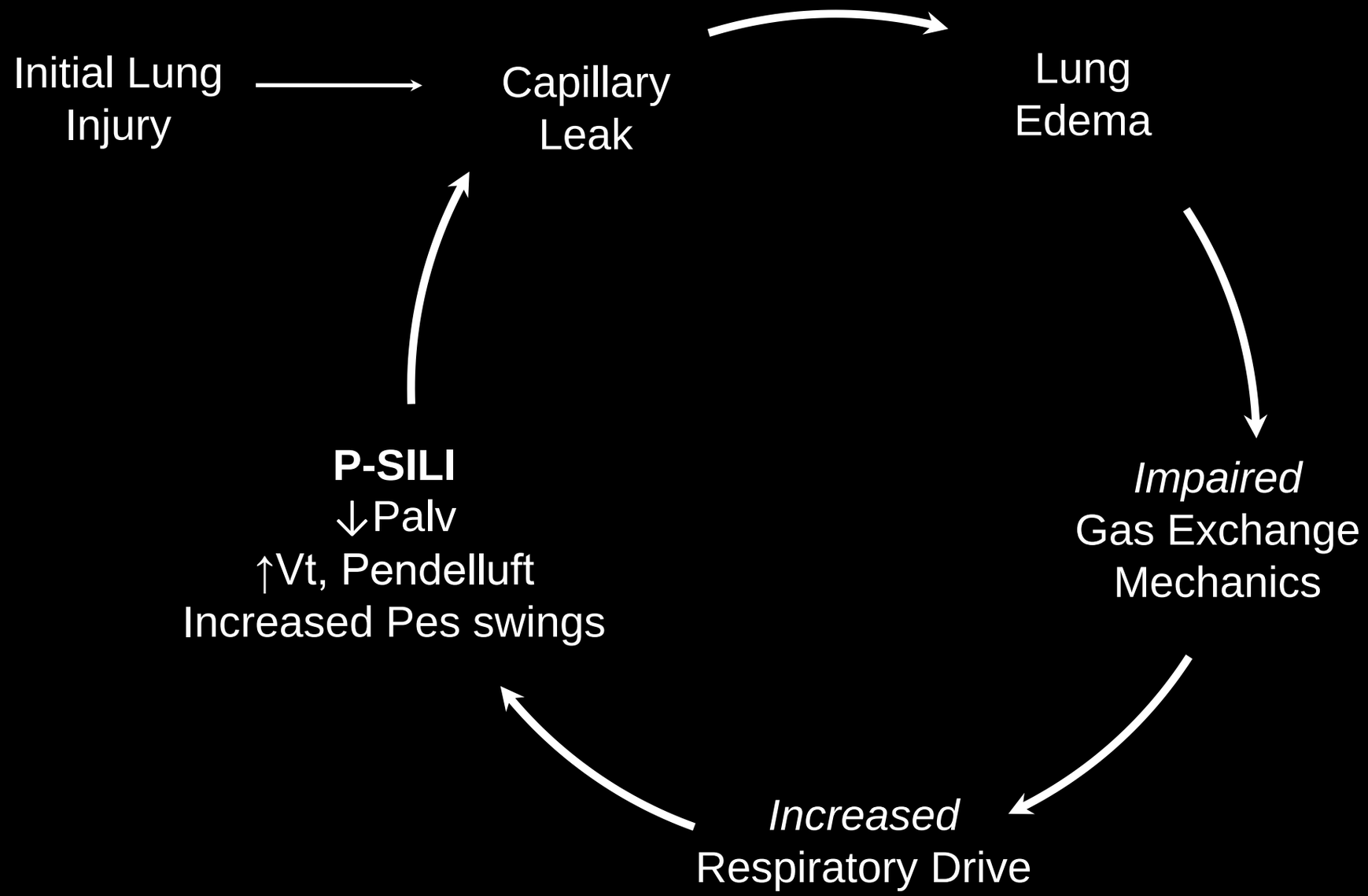
L phenotype
H phenotype

COVID-19 pneumonia, Type L

Karakteristik:

- Low elastance
- Low ventilation-to-perfusion (VA/Q) ratio
- Low lung weight
- Low lung recruitability
- Local subpleural interstitial edema (GGO) dan vasoplegia ➞ hypoxemia ➞↑VT (sampai 15 - 20 ml/kg) dan↑MV
- Compliance paru hampir normal ➞ tidak ada dyspnea, $PaCO_2$ rendah

Evolusi COVID-19: transisi antara phenotypes ➞ Patient self-inflicted lung injury (P-SILI)



Kombinasi antara negative inspiratory intrathoracic pressure dan peningkatan permeability kapiler ➞ interstitial lung edema

Brochard L, et al. *Am J Respir Crit Care Med* 2017;195:438–442

COVID-19 pneumonia, Type H

- High elastance. Edema → ↓volume gas dalam alveoli↑ elastance
- High right-to-left shunt. Aliran perfusi metewati daerah yang non-aerated dibagian dependent karena edema dan tekanan berat jaringan
- High lung weight. Quantitative analysis dari CT scan → berat paru meningkat tinggi (> 1.5 kg), seperti ARDS berat.
- High lung recruitability. Peningkatan jumlah jaringan non-aerated mirip ARDS, memungkinkan dapat di recruit

Many Faces of COVID-19

Hypoxemia

P-SILI
↓Palv
↑Vt, Pendelluft
Increased Pes swings

Dysregulation of pulmonary perfusion

- Low lung elastance
- Low V/Q
- Low recruitability
- Limited “PEEP response”

“happy hypoxia”

Phenotype L

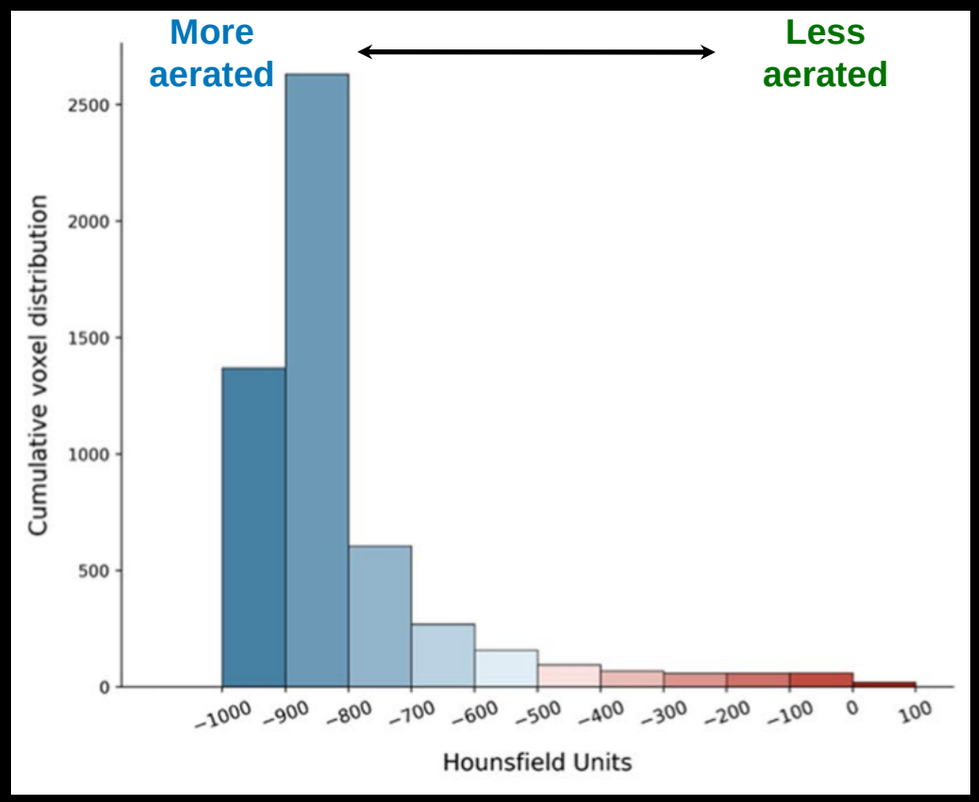
Pulmonary Micro-Thrombosis

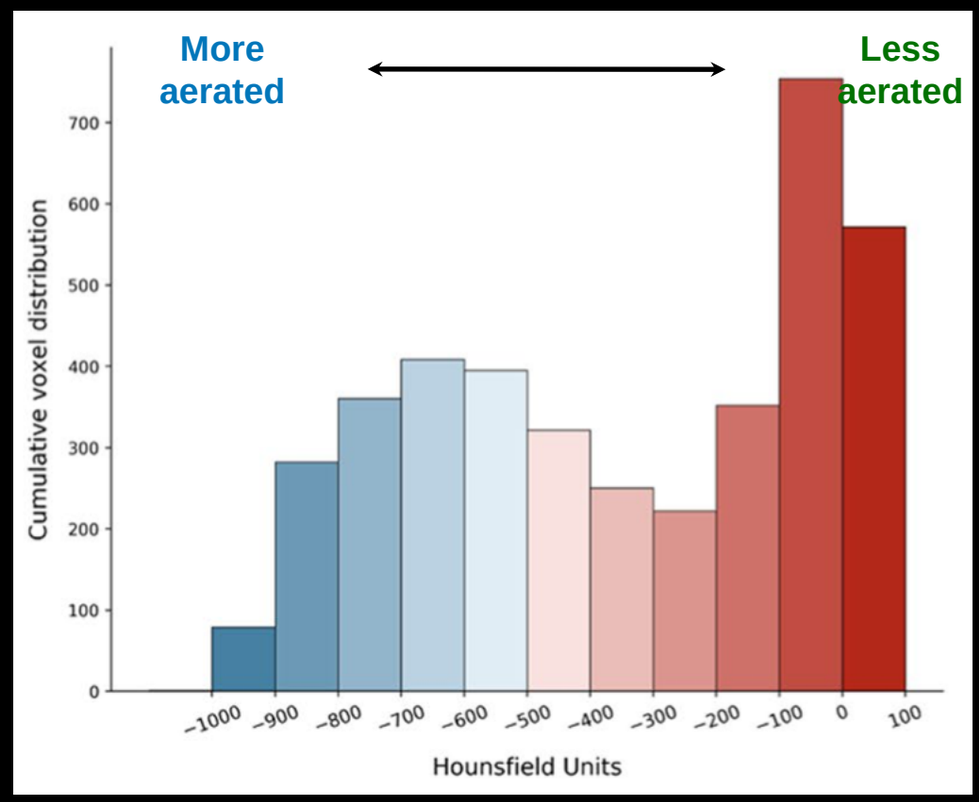
Pulmonary edema
Collapse - “ARDS Like”

- High lung elastance
- High R → L shunt
- High recruitability
- Higher “PEEP response”

severe hypoxia

Phenotype H





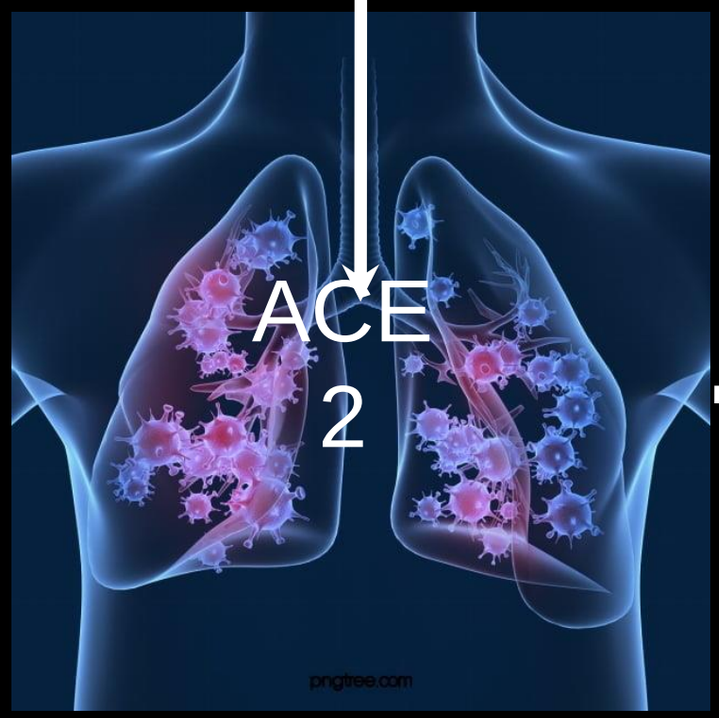
Type L (Low)

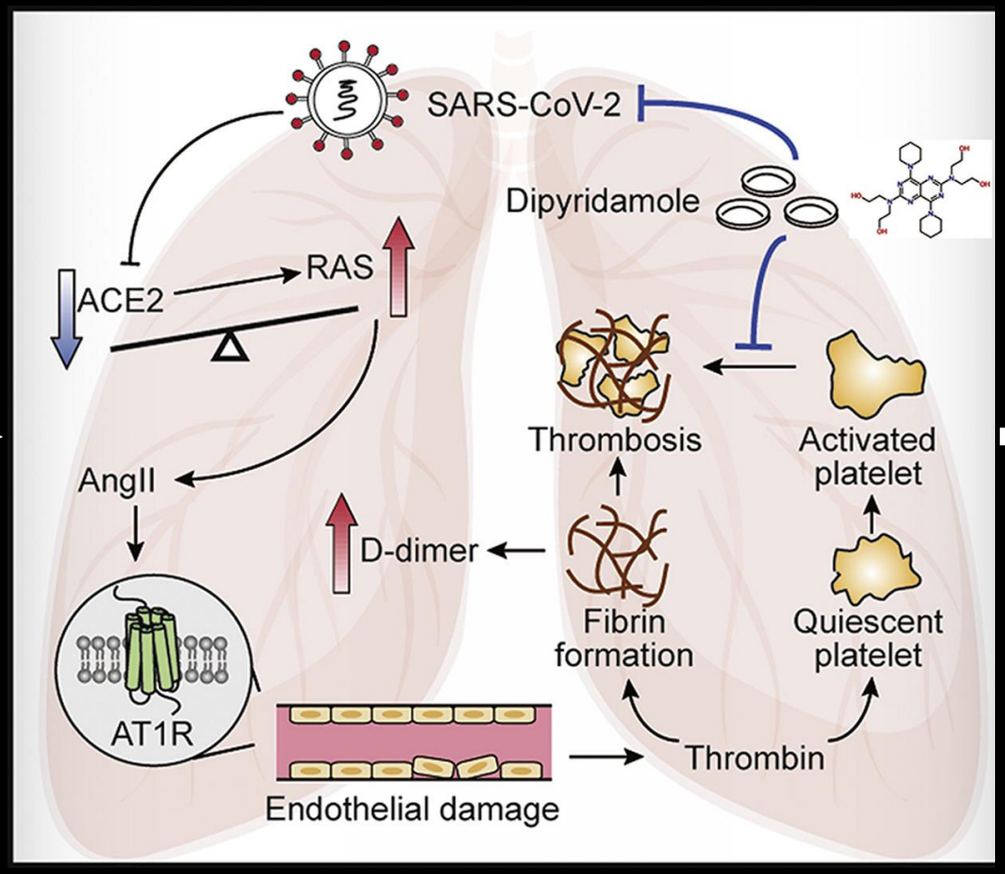
- Over 50% of patient
- Thin, compliant lungs
- Don’t fit classic ARDS profile
- $PaO_2/FiO2$ = 95 mm Hg

Type H (High)

- 20 - 30% of patient
- Stiff, heavy lungs
- Fit ARDS profile
- PaO2/FiO2 = 84 mm Hg

SARS-COV-2





ARDS

ARDS

Phenotype L

Phenotype H

Liu X, et al. Acta Pharmaceutica Sinica B (2020) https://doi.org/10.1016/j.apsb.2020.04.00

Pengelolaan ventilasi pada Covid-19 (1)

1. Langkah awal The first step to reverse hypoxemia (Type L, belum sesak): Naikkan FiO_2
2. Type L dengan dyspnea, beberapa pilihan noninvasive:
   - high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP) or noninvasive ventilation (NIV) (hati-hati aerosolized procedure).
   - ukur/estimasi work of breathing:
     - inspiratory esophageal pressure swings (esophageal pressure manometry)
     - swing dari CVP
     - pada pasien terintubasi: $P_{0.1}$ atau Pocclusion
   - Meningkatkan PEEP (hati-hati!), mungkin bisa menurunkan pleural pressure swings →↓ lingkaran setannya and stop the vicious cycle that exacerbates lung injury.
   - Proning

Gattinoni L. et al. Intensive Care Med .https://doi.org/10.1007/s00134-020-06033-2
Sun et al. Ann. *Intensive Care* 2020;10:33

Pengelolaan ventilasi pada Covid-19 (2)

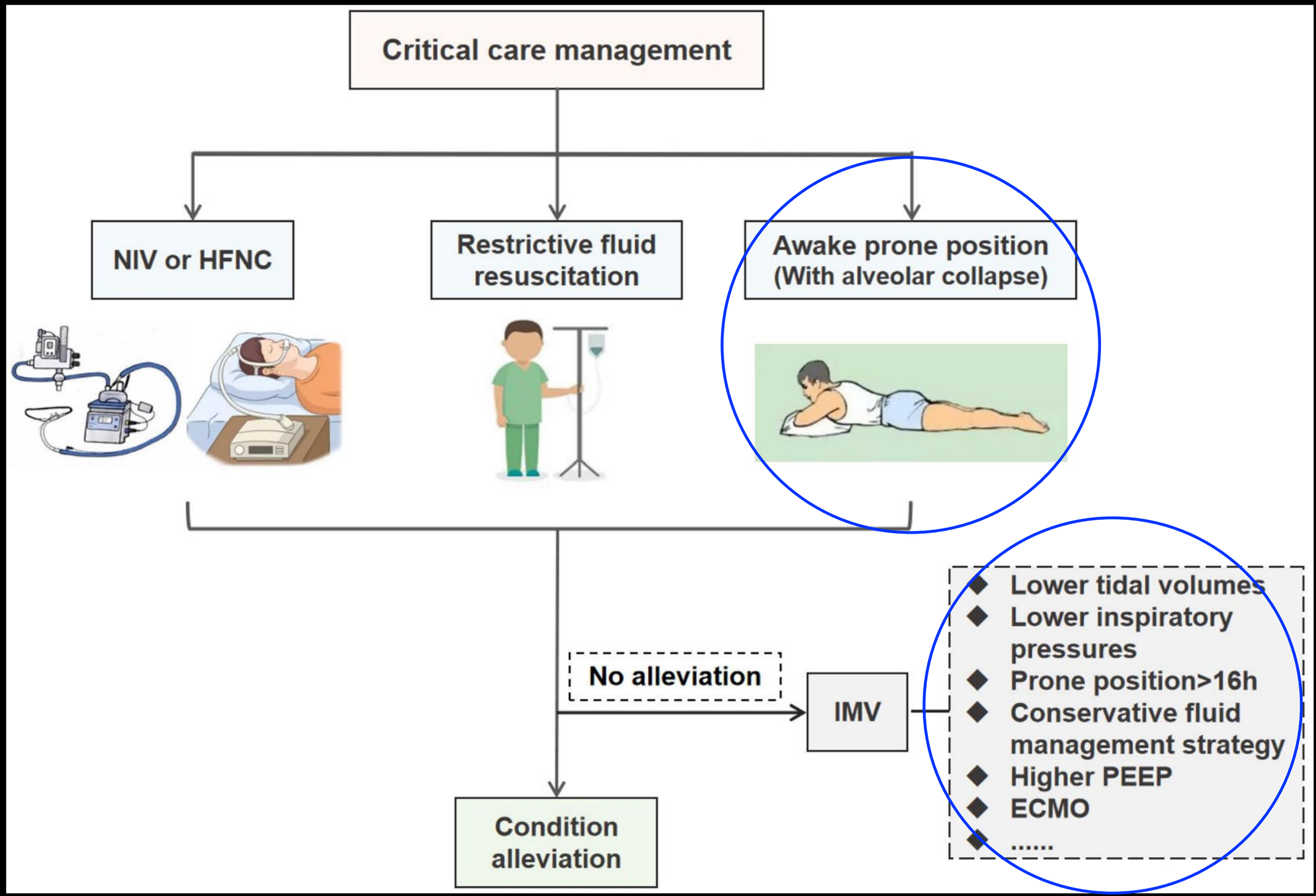
3. Tingginya inspiratory pleural pressures swings dapat menentukan transisi phenotype Type L ke Type H. Bila > 15 cmH_2O ➞ ↑ risiko cedera paru → intubasi segera!

4. Sedasi dalam setelah intubasi
   - Bila hypercapnic, VT bisa dinaikkan > 6 ml/kg (sampai 8–9 ml/kg)
   - Prone positioning digunakan sebagai rescue maneuver (mungkin lebih dini)
   - PEEP diturunkan 8–10 cmH2O, karena recruitabilitas dan resiko gangguan hemodinamik rendah

5. Intubasi dini mungkin dapat merubah perkembangan menuju phenotype Type H

Gattinoni L. et al. Intensive Care Med .https://doi.org/10.1007/s00134-020-06033-2
Sun et al. Ann. *Intensive Care* 2020;10:33

Early intervention for patients with critical condition



Sun et al. Ann. *Intensive Care* 2020;10:33

Ringkasan

- Infeksi SARS-CoV-2 mempunyai patogenesis yang berbeda dibandingkan infeksi corona virus sebelumnya
- Sementara patogenesisnya belum jelas, pola penanganan di ICU termasuk ventilasi mekanis dan terapi penunjang yang lain harus disesuaikan dengan perbedaannya
- Mortalitas dengan ventilasi mekanis yang tinggi dengan demikian diharapkan dapat lebih diturunkan bila penanganan pra ICU juga semakin baik dan pasien dimasukkan ke ICU dalam kondisi yang lebih awal

Take home message

APRIL 20, 2020

SPECIAL REPORT: HEROES OF THE FRONT LINES

TIME

Aakah anda siap berperang melawan COVID-19 dan penerusnya?