# Nouvelle définition du SDRA : quel intérêt ?

**Pr Souheil Elatrous**

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# Pourquoi une définition du SDRA ?

- **Absence** de « Gold standard » pour le diagnostic

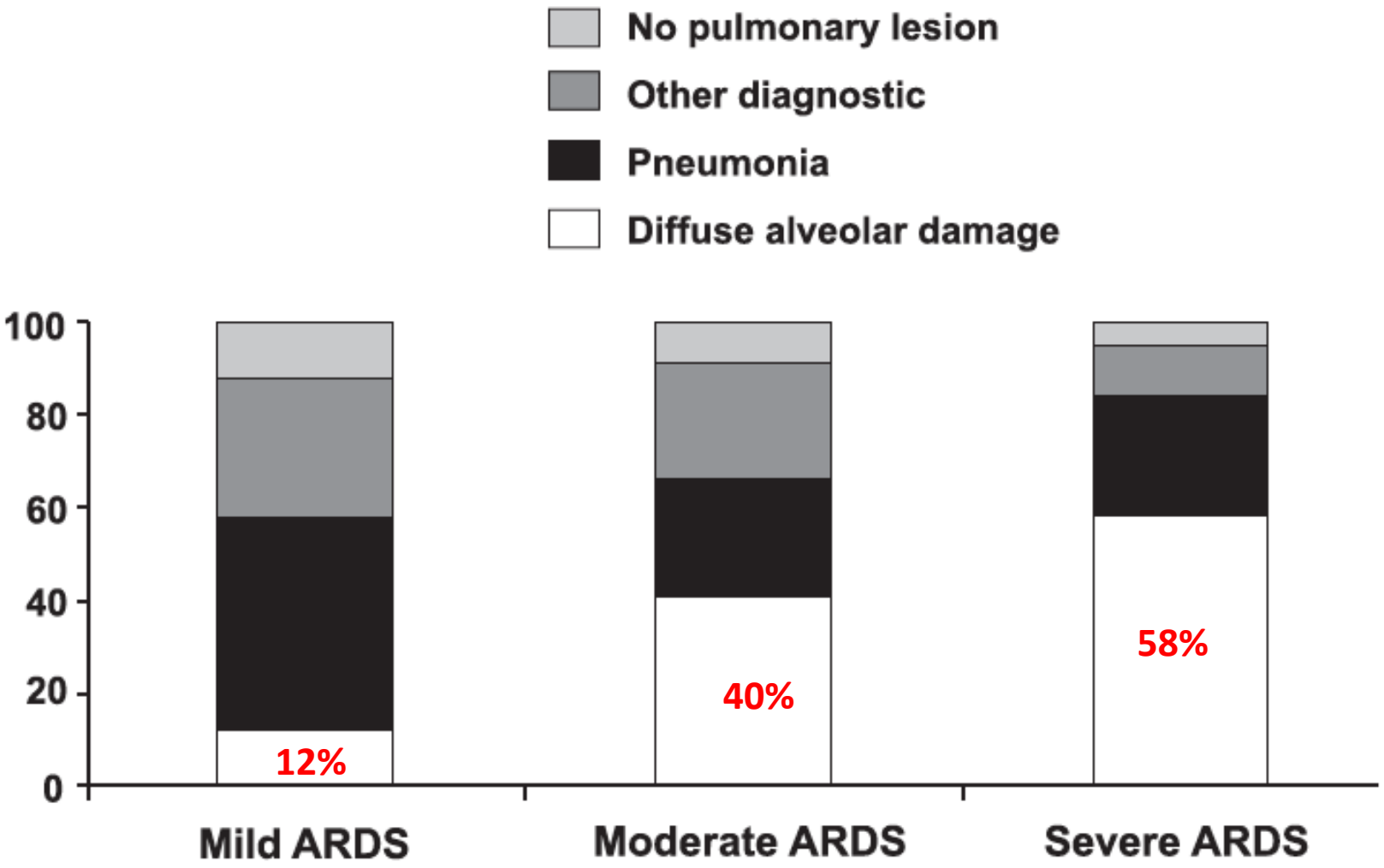
→ Idéalement  biopsie et étude histologique

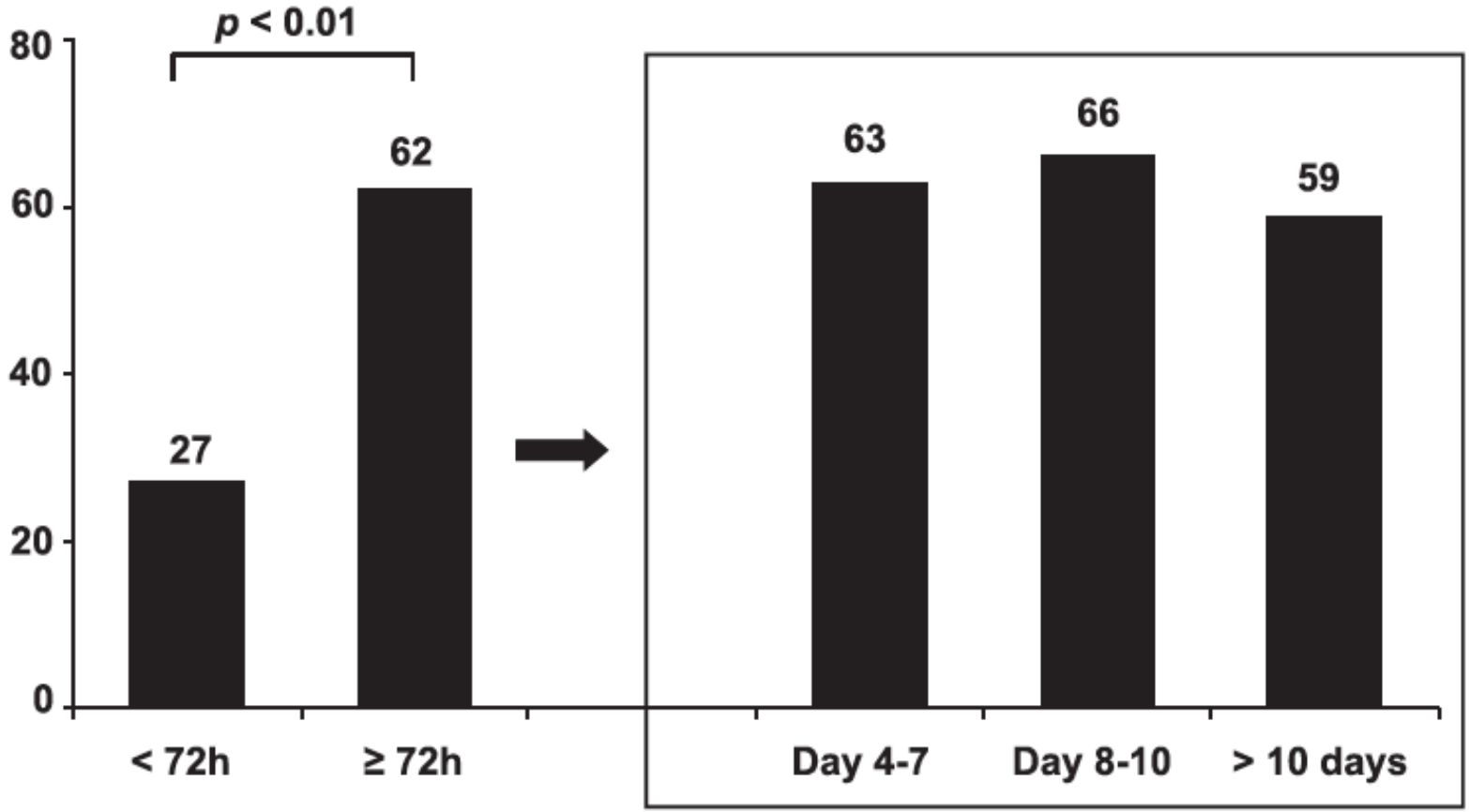
# Comparison of the Berlin Definition for Acute Respiratory Distress Syndrome with Autopsy

Arnaud W. Thille[1,3], Andrés Esteban[1], Pilar Fernández-Segoviano[2], José-Maria Rodriguez[2], José-Antonio Aramburu[2], Oscar Peñuelas[1], Irene Cortés-Puch[1], Pablo Cardinal-Fernández[1], José A. Lorente[1], and Fernando Frutos-Vivar[1]

- Évaluation de la précision de la définition de Berlin comparé au **lésions alvéolaires diffuse** à l'autopsie
- 712 autopsies sur 20 ans
- 356 ont les critères de SDRA au moment du décès
  - 49 (14%) minimes
  - 141(40%) modérés
  - 166(46%) sévères
- Lésions alvéolaires diffuses retrouvées dans **45%**

***Am J Respir Crit Care Med Vol 187, 7, 761–767, 2013***


No pulmonary lesion
Other diagnostic
Pneumonia
Diffuse alveolar damage
100
80
60
40
20
0
12%
40%
58%
Mild ARDS
Moderate ARDS
Severe ARDS


p < 0.01
80
60
40
20
0
27
62
63
66
59
< 72h
≥ 72h
Day 4-7
Day 8-10
> 10 days

# Intérêts pour les cliniciens

## Définition ARDS

1. Diagnostic rapide et pouvoir mettre en œuvre les résultats des ECR positifs dans la pratique clinique
2. Discussions pronostiques avec les patients / familles
3. Allocation des ressources

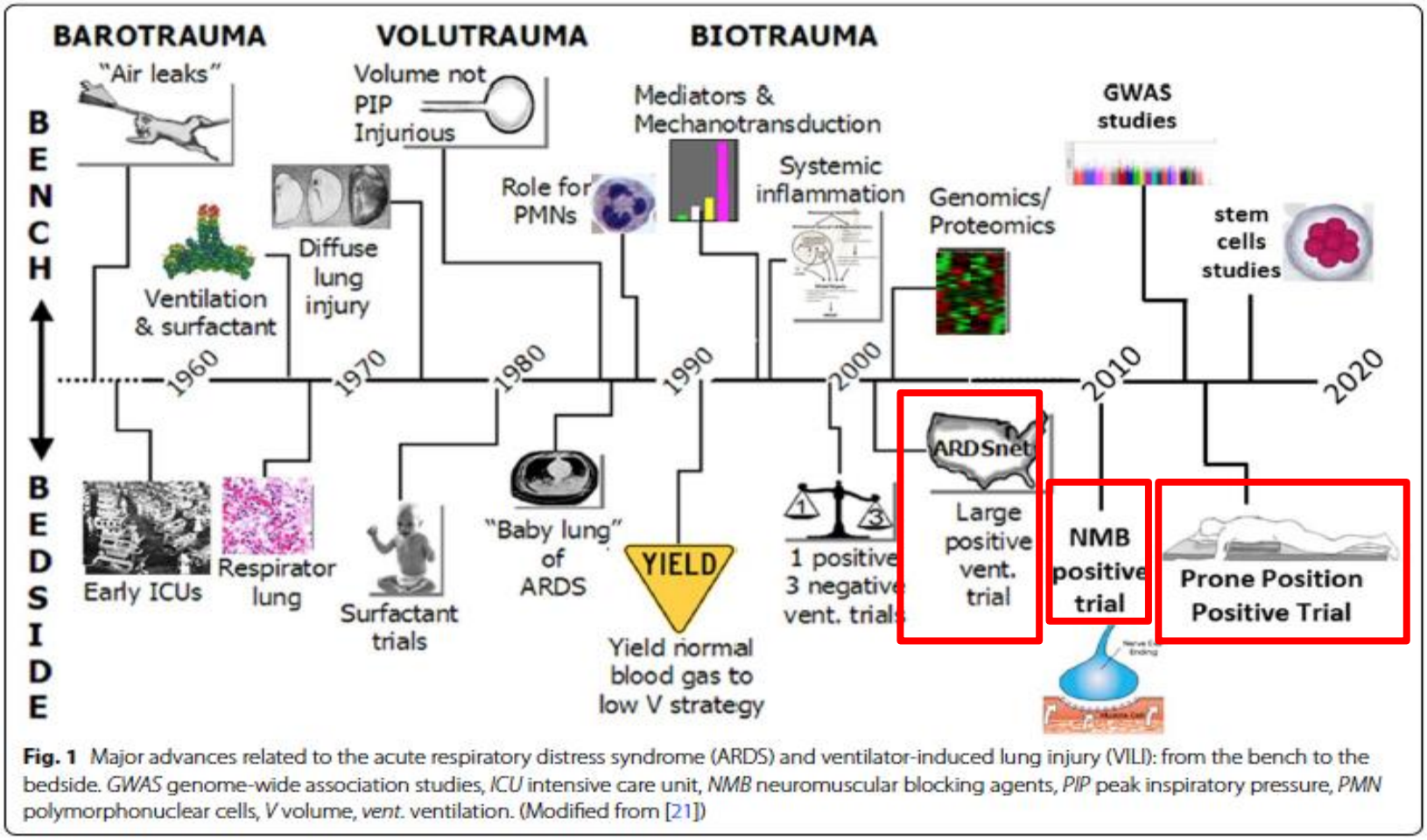



**Fig. 1** Major advances related to the acute respiratory distress syndrome (ARDS) and ventilator-induced lung injury (VILI): from the bench to the bedside. *GWAS* genome-wide association studies, *ICU* intensive care unit, *NMB* neuromuscular blocking agents, *PIP* peak inspiratory pressure, *PMN* polymorphonuclear cells, *V* volume, *vent.* ventilation. (Modified from [21])

# Intérêts pour les cliniciens

## Définition ARDS

1. Diagnostic rapide et pouvoir mettre en œuvre les résultats des ECR positifs dans la pratique clinique
2. Discussions pronostiques avec les patients / familles
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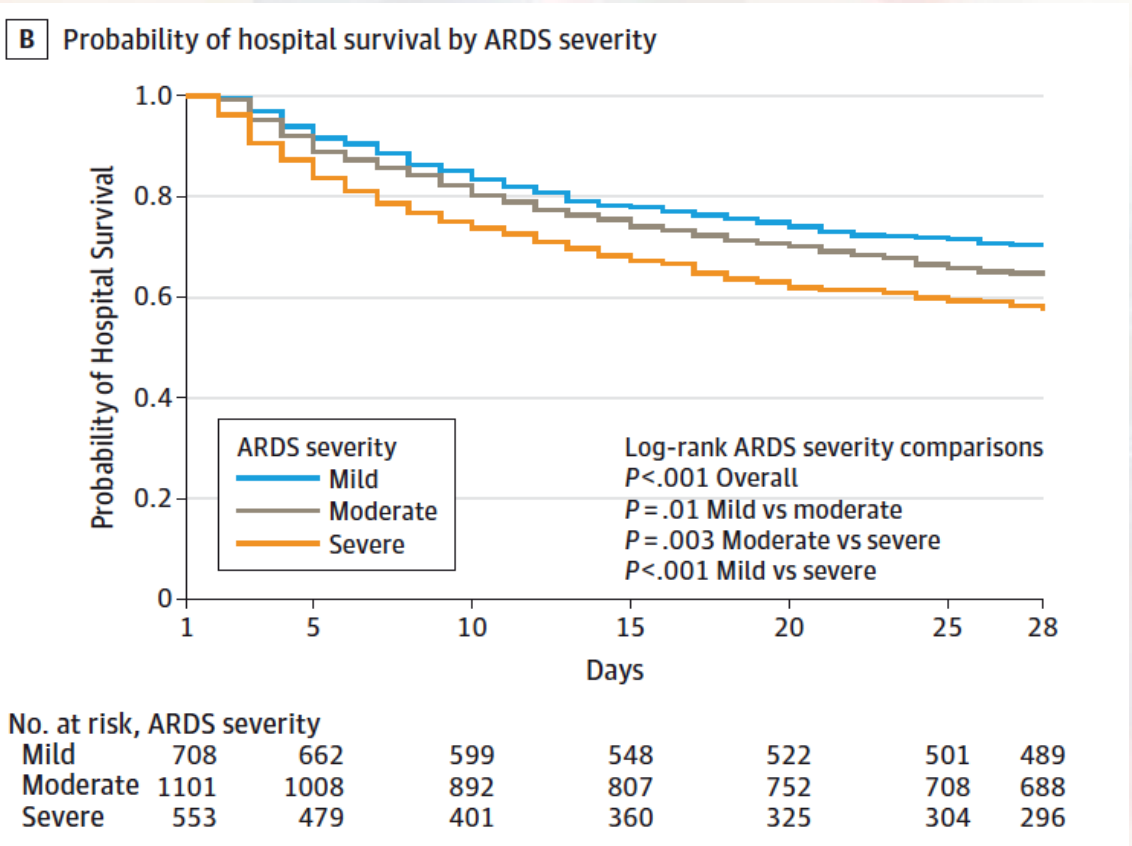
JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

# Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries

Giacomo Bellani, MD, PhD; John G. Laffey, MD, MA; Tài Pham, MD; Eddy Fan, MD, PhD; Laurent Brochard, MD, HDR; Andres Esteban, MD, PhD; Luciano Gattinoni, MD, FRCP; Frank van Haren, MD, PhD; Anders Larsson, MD, PhD; Daniel F. McAuley, MD, PhD; Marco Ranieri, MD; Gordon Rubenfeld, MD, MSc; B. Taylor Thompson, MD, PhD; Hermann Wrigge, MD, PhD; Arthur S. Slutsky, MD, MASc; Antonio Pesenti, MD; for the LUNG SAFE Investigators and the ESICM Trials Group




No. at risk, ARDS severity

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mild | 708 | 662 | 599 | 548 | 522 | 501 | 489 |
| Moderate | 1101 | 1008 | 892 | 807 | 752 | 708 | 688 |
| Severe | 553 | 479 | 401 | 360 | 325 | 304 | 296 |

# Intérêts pour les cliniciens

## Définition ARDS

1. Capacité à mettre en œuvre les résultats des ECR positifs dans la pratique clinique
2. Peut aussi être utile dans les discussions pronostiques avec les patients / familles
3. **Allocation des ressources**

# Intérêts pour les chercheurs

## Définition ARDS

1. Conduire des études épidémiologiques
2. Faciliter l‘inclusion des patients dans les essais cliniques
3. Permettre la comparaison entre les études

# Définition ARDS

Murray 1988

Ashbaugh 1967

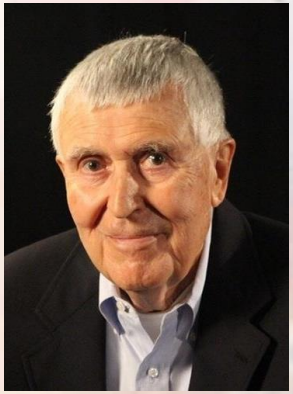
AECC 1994

Berlin 2012

Kigali 2015

Global definition 2023


# 1ère description Ashbaugh 1967



## ACUTE RESPIRATORY DISTRESS IN ADULTS

DAVID G. ASHBAUGH
M.D. Ohio State
ASSISTANT PROFESSOR OF SURGERY

D. BOYD BIGELOW
M.D. Colorado
ASSISTANT IN MEDICINE AND AMERICAN THORACIC SOCIETY-NATIONAL TUBERCULOSIS ASSOCIATION FELLOW IN PULMONARY DISEASE

THOMAS L. PETTY
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ASSISTANT PROFESSOR OF MEDICINE

BERNARD E. LEVINE
M.D. Michigan
AMERICAN THORACIC SOCIETY-NATIONAL TUBERCULOSIS ASSOCIATION FELLOW IN PULMONARY DISEASE*

*From the Departments of Surgery and Medicine, University of Colorado Medical Center, Denver, Colorado, U.S.A.*

"The clinical pattern, which we will refer to as the respiratory-distress syndrome, includes

- severe dyspnea
- tachypnea
- cyanosis that is refractory to oxygen therapy
- loss of lung compliance
- diffuse alveolar infiltration seen on CXR"

12 patients (7 trauma, 4 viral infection, 1 pancreatitis)

The Lancet · Saturday 12 August 1967

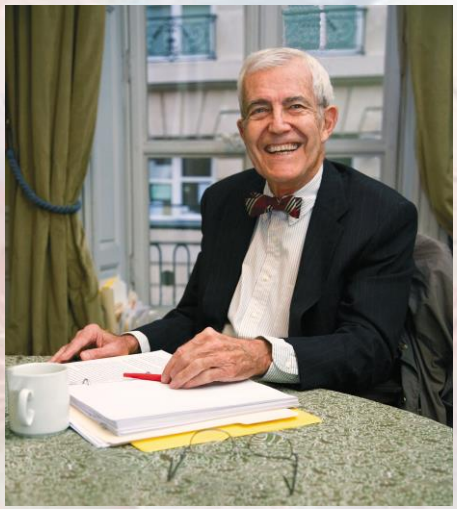
Berlin 2012

Murray 1988

AECC 1994

Kigali 2015

1ère description
Ashbaugh 1967



# Murray
# Lung injury score 1988

| | Score |
|---|---|
| Chest radiograph | |
| No alveolar consolidation | 0 |
| Alveolar consolidation confined to 1 quadrant | 1 |
| Alveolar consolidation confined to 2 quadrants | 2 |
| Alveolar consolidation confined to 3 quadrants | 3 |
| Alveolar consolidation confined to 4 quadrants | 4 |
| Hypoxaemia score | |
| $PaO_2/FiO_2 \geq 300$ | 0 |
| $PaO_2/FiO_2$ 225–299 | 1 |
| $PaO_2/FiO_2$ 175–224 | 2 |
| $PaO_2/FiO_2$ 100–174 | 3 |
| $PaO_2/FiO_2 < 100$ | 4 |
| PEEP score (when mechanically ventilated) | |
| $\leq 5$ cm $H_2O$ | 0 |
| 6–8 cm $H_2O$ | 1 |
| 9–11 cm $H_2O$ | 2 |
| 12–14 cm $H_2O$ | 3 |
| $\geq 15$ cm $H_2O$ | 4 |
| Respiratory system compliance score (when available) | |
| $\geq 80$ ml/cm $H_2O$ | 0 |
| 60–79 ml/cm $H_2O$ | 1 |
| 40–59 ml/cm $H_2O$ | 2 |
| 20–39 ml/cm $H_2O$ | 3 |
| $\leq 19$ ml/cm $H_2O$ | 4 |
| The score is calculated by adding the sum of each component and dividing by the number of components used. | |
| No lung injury | 0 |
| Mild to moderate lung injury | 0.1–2.5 |
| Severe lung injury (ARDS) | >2.5 |


**The American-European Consensus Conference on ARDS**
Definitions, Mechanisms, Relevant Outcomes, and Clinical Trial Coordination

GORDON R. BERNARD, ANTONIO ARTIGAS, KENNETH L. BRIGHAM, JEAN CARLET, KONRAD FALKE, LEONARD HUDSON, MAURICE LAMY, JEAN ROGER LEGALL, ALAN MORRIS, ROGER SPRAGG, and the Consensus Committee


# Conférence de consensus AECC 1994

| | Timing | Oxygenation | Chest Radiograph | Pulmonary Artery Wedge Pressure |
|---|---|---|---|---|
| ALI criteria | Acute onset | $Pao_2 \leq 300$ mm Hg (regardless of PEEP level) | Bilateral infiltrates seen on frontal chest radiograph | ≤ 18 mm Hg when measured or no clinical evidence of left atrial hypertension |
| ARDS criteria | Acute onset | $Pa_{O2}/Fio_2 \leq 200$ mm Hg (regardless of PEEP level) | Bilateral infiltrates seen on frontal chest radiograph | ≤ 18 mm Hg when measured or no clinical evidence of left atrial hypertension |

Am J Respir Crit Care Med 1994;149:818–24.

## AECC Definition

## Les limites AECC

**Début**

**Début aigü**

**Absence de définition de laps de temps spécifique : heures, jours, semaines**

**$O_2$**

**PaO2/FIO2 ≤300 mm Hg (independent de la PEEP)**

**Rapport Pao2 / Fio2 n'est pas constant, il peut varier en réponse au réglage du ventilateur: $FiO_2$, particulièrement PEEP**

**Radio**

**Radiographies du thorax**
**Bilateral infiltrates observed on frontal chest radiograph**

**Concordance inter observateur modérée même lorsqu'il est appliqué par des experts**

**PAPO**

**PAPO < 18 mm Hg**
**Absence d'évidence clinique d'élévation de la pression OG**

**Les patients atteints de SDRA peuvent avoir une élévation de la PAPO : en raison de transmission des pressions des voies aériennes et / ou d'un remplissage rigoureux en réanimation**
**Concordance inter-observateur faible**

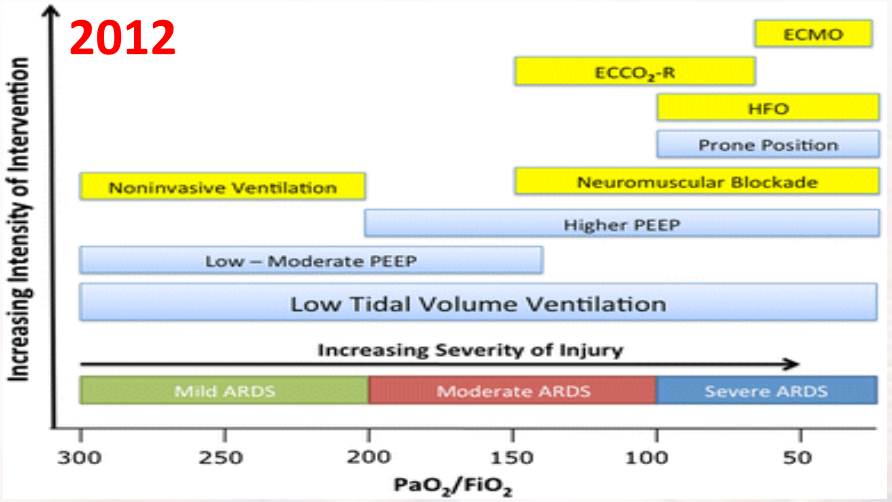

# Définition de Berlin


**Table 1.** ARDS Berlin definition.

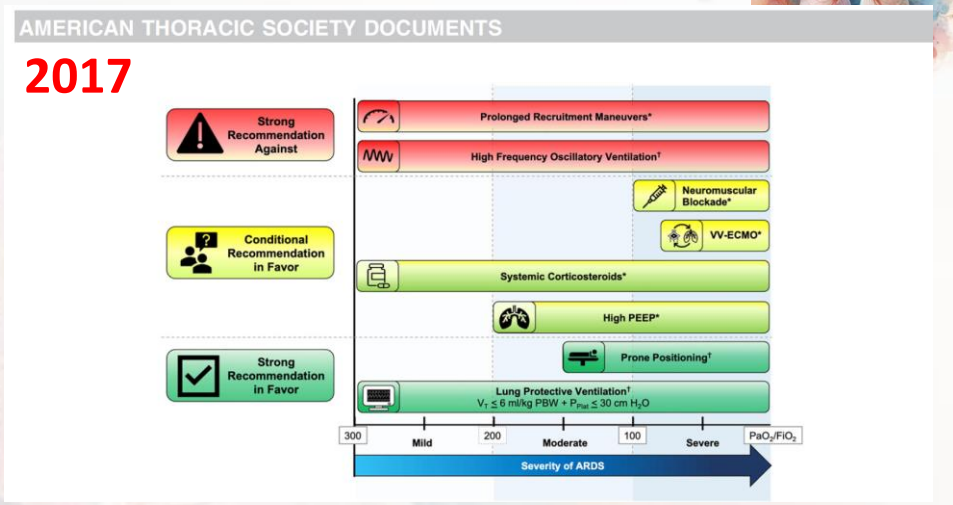
| The Berlin definition of acute respiratory distress syndrome | |
|---|---|
| Timing | Within 1 week of a known clinical insult or new or worsening respiratory symptoms |
| Chest imaging[a] | Bilateral opacities — not fully explained by effusions, lobar/lung collapse, or nodules |
| Origin of edema | Respiratory failure not fully explained by cardiac failure or fluid overload.<br>Need objective assessment (e.g., echocardiography) to exclude hydrostatic edema if no risk factor present |
| Oxygenation[b] | |
| Mild | 200 mmHg < $PaO_2/FIO_2$ ≤300 mmHg with PEEP or CPAP ≥5 $cmH_2O$[c] |
| Moderate | 100 mmHg < $PaO_2/FIO_2$ ≤200 mmHg with PEEP ≥5 $cmH_2O$ |
| Severe | $PaO_2/FIO_2$ ≤100 mmHg with PEEP ≥5 $cmH_2O$ |

# Recommandations

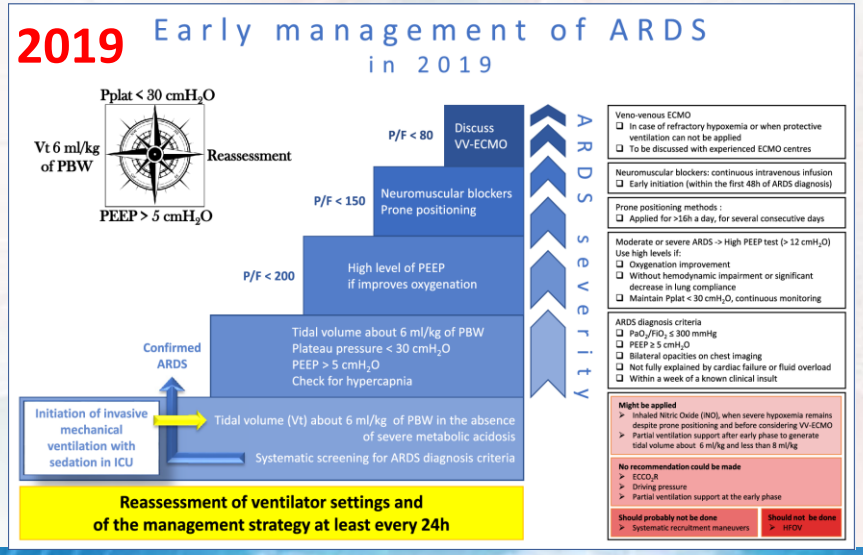
## 2012




## 2017




## 2019



Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

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## Table 1. Characteristics of Patients With Acute [illegible] Syndrome

| Parameter | |
|---|---|
| No. of patients | |
| ARDS | |
| ARDS in first 48 h after AHRF | 2813 |
| No longer fulfill ARDS criteria after 24 h, No. (%) [95% CI] | 486 (17) [15.9-1[illegible]] |
| Clinician recognition of ARDS, No. (%) [95% CI] | 1820 (60) [59-62.0] |

**Les cliniciens ne reconnaissent Pas L'ARDS que dans 40% des cas**

# Reconnaissance de L'ARDS

- Les cliniciens reconnaissent l'ARDS
  - SDRA minime 51.3% (95% CI, 47.5%-55.0%) f
  - SDRA sévère : 78.5% (95% CI, 74.8%-81.8%) .
- Les cliniciens reconnaissent l'ARDS quand les patients remplissent des critères que dans 34.0% (95% CI, 32.0-36.0),

**Le Diagnostic est souvent retardé**

# Problèmes avec la définition de Berlin

**Délai**

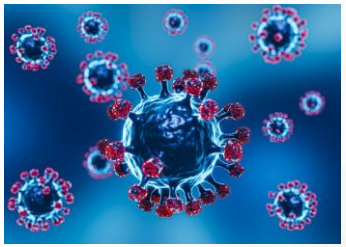
**Table 1.** ARDS Berlin definition.

| The Berlin definition of acute respiratory distress syndrome | |
|---|---|
| Timing | Within 1 week of a known clinical insult or new or worsening respiratory symptoms |
| Chest imaging[a] | Bilateral opacities — not fully explained by effusions, lobar/lung collapse, or nodules |
| Origin of ede[illegible]a | Respiratory failure not fully explained by cardiac failure or fluid overload.<br>Need objective assessment (e.g., echocardiography) to exclude hydrostatic edema if no ri[illegible] factor present |
| Oxygenat[illegible] | |
| Mild | 200 mmHg < $PaO_2/FIO_2$ ≤300 mmHg with PEEP or CPAP ≥5 $cmH_2O$[c] |
| M[illegible] | 100 mmHg < $PaO_2/FIO_2$ ≤[illegible] mmHg with PEEP ≥5 $cmH_2O$ |
| | $PaO_2/FIO_2$ ≤100 mmHg with PEEP ≥[illegible] $H_2O$ |

**Usage de HFNO et la VNI**

**Echographie pulmonaire et TDM**

**SPO2/FiO2**

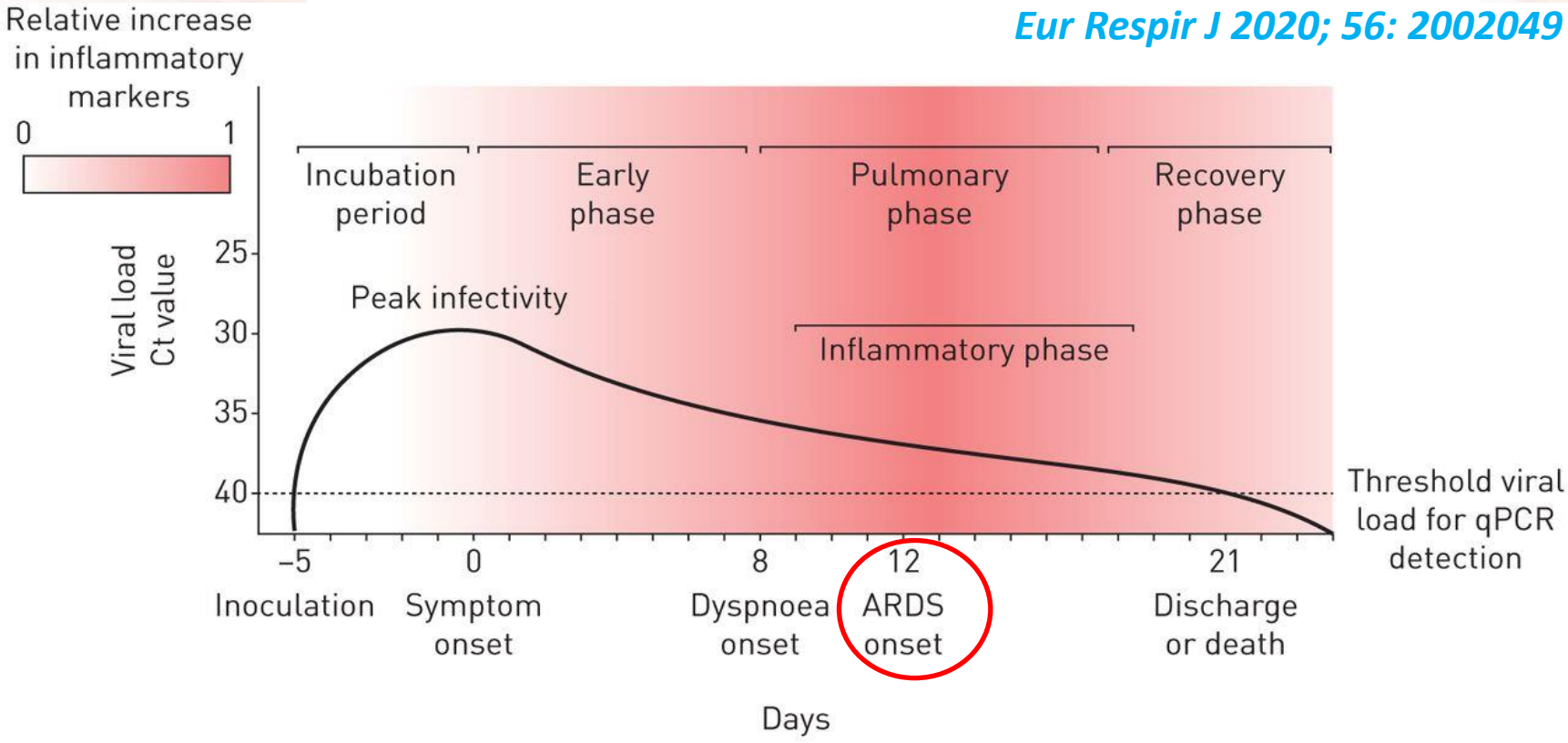


# Le délai

## Pathogenesis of COVID-19-induced ARDS: implications for an ageing population

Manuel A. Torres Acosta [1] and Benjamin D. Singer [1,2,3]

*Eur Respir J 2020; 56: 2002049*



# Pays à faible ressources


ORIGINAL ARTICLE

## Hospital Incidence and Outcomes of the Acute Respiratory Distress Syndrome Using the Kigali Modification of the Berlin Definition

Elisabeth D. Riviello[1,2], Willy Kiviri[3], Theogene Twagirumugabe[3], Ariel Mueller[4], Valerie M. Banner-Goodspeed[4], Laurent Officer[4], Victor Novack[5], Marguerite Mutumwinka[6], Daniel S. Talmor[4], and Robert A. Fowler[7]

[1]Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, and [4]Department of Anesthesia, Critical Care and Pain Management, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, Massachusetts; [2]Department of Medicine and [3]Department of Anesthesia, University of Rwanda, College of Medicine and Health Sciences, Kigali, Rwanda; [5]Clinical Research Center, Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer Sheva, Israel; [6]University Teaching Hospital of Kigali, Kigali, Rwanda; and [7]Department of Critical Care Medicine and Department of Medicine, Sunnybrook Hospital, Interdepartmental Division of Critical Care, University of Toronto, Toronto, Ontario, Canada

*AJRCCM Volume 193 Number 1 | January 1 2016*

**Table 1.** Berlin Criteria for ARDS, Challenges in Resource-Poor Settings, and Kigali Modification of the Berlin Criteria to Address These Challenges

| | Berlin Criteria | Challenges in Resource Poor Settings | Kigali Modification of the Berlin Criteria |
|---|---|---|---|
| Timing | Within 1 wk of a known clinical insult or new or worsening respiratory symptoms | None | Within 1 wk of a known clinical insult or new or worsening respiratory symptoms |
| Oxygenation | $Pa_{O_2}/FI_{O_2}$ ≤300 | Scarcity of arterial blood gas diagnostics | $Sp_{O_2}/FI_{O_2}$ ≤315 |
| PEEP requirement | Minimum 5 cm $H_2O$ PEEP required by invasive mechanical ventilation (noninvasive acceptable for mild ARDS) | Scarcity of mechanical ventilators | No PEEP requirement, consistent with AECC definition |
| Chest imaging | Bilateral opacities not fully explained by effusions, lobar/lung collapse, or nodules by chest radiograph or CT | Scarcity of chest radiography resources | Bilateral opacities not fully explained by effusions, lobar/lung collapse, or nodules by chest radiograph or ultrasound |
| Origin of edema | Respiratory failure not fully explained by cardiac failure or fluid overload (need objective assessment, such as echocardiography, to exclude hydrostatic edema if no risk factor present) | None | Respiratory failure not fully explained by cardiac failure or fluid overload (need objective assessment, such as echocardiography, to exclude hydrostatic edema if no risk factor present) |

## Pulse oximetry for the diagnosis and management of acute respiratory distress syndrome

Katherine D Wick, Michael A Matthay, Lorraine B Ware

Lancet Respir Med 2022; 10: 1086–98

# SpO2/FiO2 ratio ≤ 315

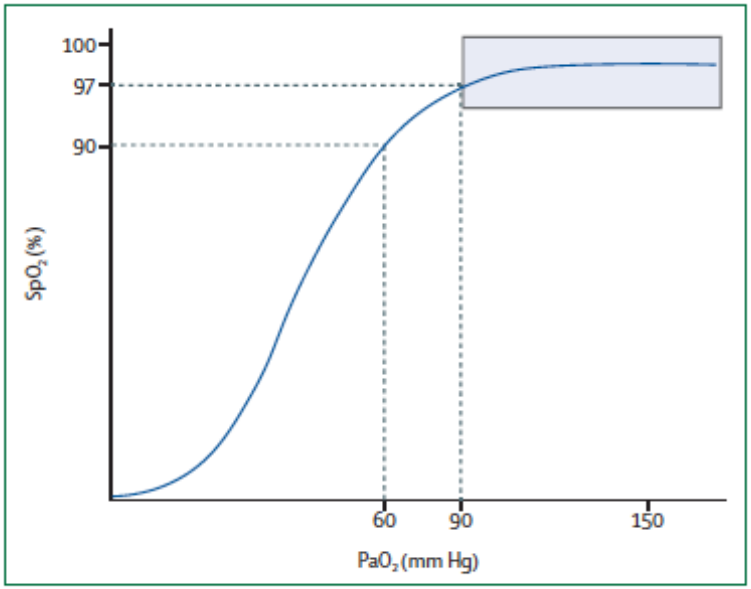



*Figure 1:* Oxyhaemoglobin dissociation curve

### *Panel:* Advantages and disadvantages of $SpO_2$ measurements in ARDS

**Advantages**

- Continuously available
- Highly sensitive for hypoxaemia
- Easily interpretable
- Non-invasive, no risk of procedural complications
- More readily available than $PaO_2$ in resource-limited settings

**Disadvantages**

- Measurement error can be increased by conditions commonly seen in the intensive care unit, such as poor perfusion and vasopressor use, severe hypoxaemia, or acidaemia
- Potential for reduced accuracy in patients with darker skin pigmentation
- Potential for misclassification of diagnosis or severity in ARDS

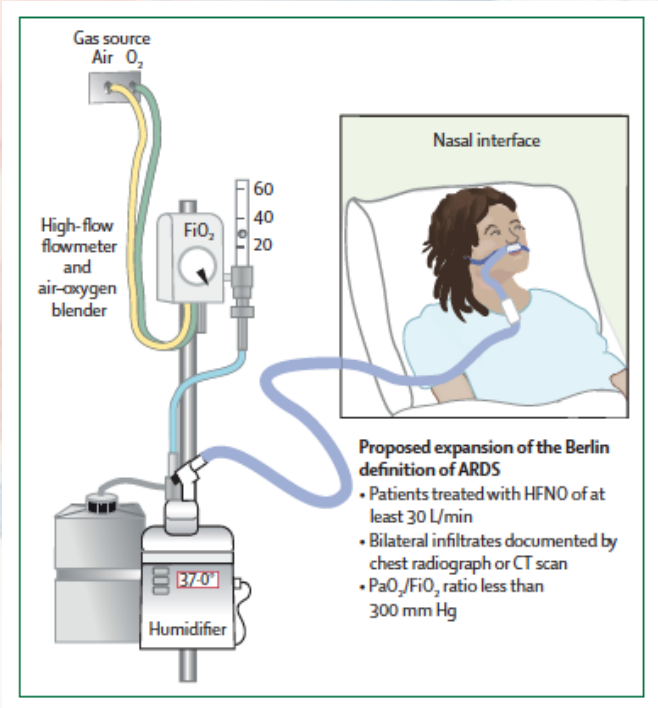
ARDS=acute respiratory distress syndrome. $PaO_2$=partial pressure of arterial oxygen. $SpO_2$=pulse-oximetric oxygen saturation.

# Usage de l'oxygène haut débit

## The Berlin definition of acute respiratory distress syndrome: should patients receiving high-flow nasal oxygen be included?

Michael A Matthay, B Taylor Thompson, Lorraine B Ware

www.thelancet.com/respiratory Vol 9 August 2021

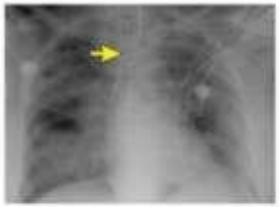



### *Panel:* Questions to address in considering an expanded definition of ARDS

The proposal to include patients receiving HFNO in an expanded definition of ARDS could be evaluated in several forums. Areas of uncertainty and other potential modifications to the Berlin definition are listed below. These questions could be addressed in randomised controlled trials or observational studies that include patients recruited at an early stage of respiratory failure.

- Is an HFNO cutoff of 30 L/min optimal?
- Should the latency period for the inciting clinical disorder be increased to 14 days rather than 7 days, a point that is especially relevant to viral pneumonia and COVID-19?
- Should the use of a $SpO_2/FiO_2$ ratio of less than or equal to 315 be formally integrated as an oxygenation criterion?
- Should the radiographic criteria be modified to include two quadrants, independent of whether the infiltrates are bilateral or unilateral?

ARDS=acute respiratory distress syndrome. HFNO=high-flow nasal oxygen. $SpO_2/FiO_2$=ratio of pulse oximetric oxygen saturation to fraction of inspired oxygen.

| Patient Description | Imaging | Oxygenation | ARDS Categories |
|---|---|---|---|
|  68 M with abdominal sepsis, septic shock, and acute hypoxemic respiratory failure |  | Mechanically ventilated<br>$FiO_2$ 0.5<br>$PaO_2$ 75<br>P/F = 150 | **Intubated ARDS**<br>Severity: Moderate<br>*Typical patient included in prior Berlin definition* |
|  54 F with history of breast cancer, COVID-19 pneumonia, and worsening SOB for the past 6 days |  | High flow nasal oxygen<br>HFNO 40L/min<br>$FiO_2$ 0.80<br>$SpO_2$ 91%<br>S/F = 114 | **Non-Intubated ARDS**<br>*New category in Global definition* |

**Criteria That Apply to Specific ARDS Categories**

| | Nonintubated ARDS† | Intubated ARDS | Modified Definition for Resource-Limited Settings‡ |
|---|---|---|---|
| Oxygenation§‖ | $Pa_{O_2}:FI_{O_2} \leq 300$ mm Hg or $Sp_{O_2}:FI_{O_2} \leq 315$ (if $Sp_{O_2} \leq 97\%$) on HFNO with flow of ⩾30 L/min or NIV/CPAP with at least 5 cm $H_2O$ end-expiratory pressure | Mild¶: $200 < Pa_{O_2}:FI_{O_2} \leq 300$ mm Hg or $235 < Sp_{O_2}:FI_{O_2} \leq 315$ (if $Sp_{O_2} \leq 97\%$)<br>Moderate: $100 < Pa_{O_2}:FI_{O_2} \leq 200$ mm Hg or $148 < Sp_{O_2}:FI_{O_2} \leq 235$ (if $Sp_{O_2} \leq 97\%$)<br>Severe: $Pa_{O_2}:FI_{O_2} \leq 100$ mm Hg or $Sp_{O_2}:FI_{O_2} \leq 148$ (if $Sp_{O_2} \leq 97\%$) | $Sp_{O_2}:FI_{O_2} \leq 315$ (if $Sp_{O_2} \leq 97\%$)†. Neither positive end-expiratory pressure nor a minimum flow rate of oxygen is required for diagnosis in resource-limited settings. |

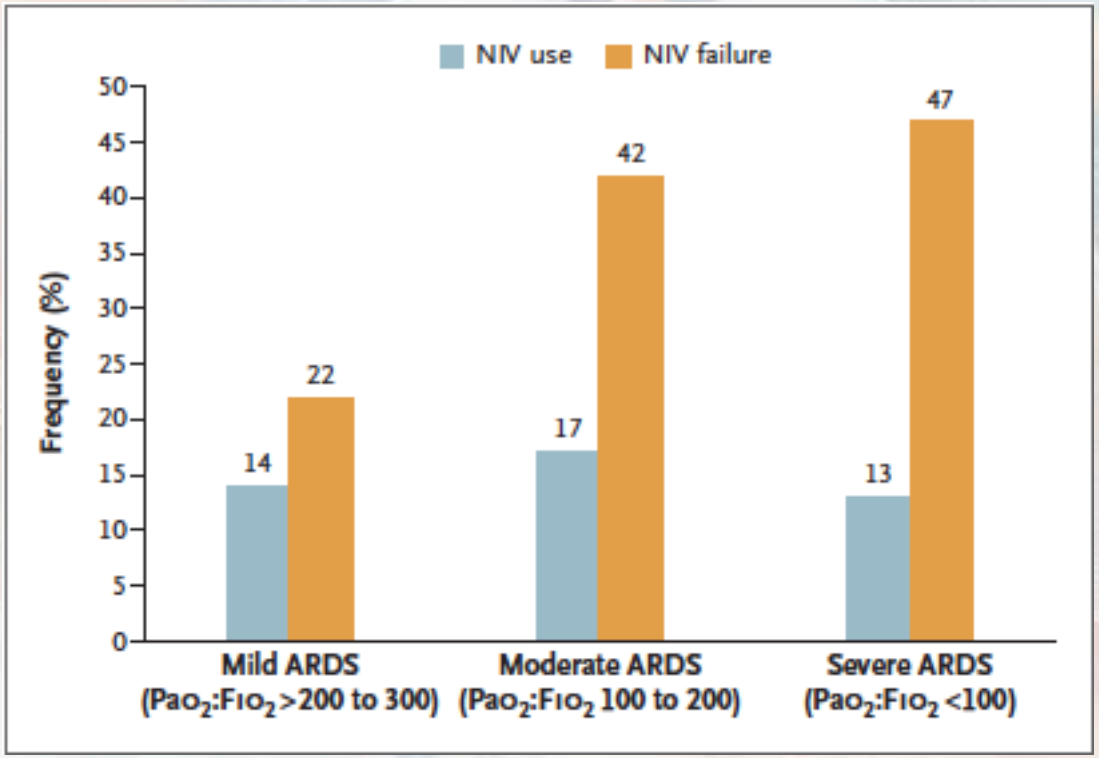
# VNI et SDRA

C. Corey Hardin, M.D., Ph.D., *Editor*

## Noninvasive Respiratory Support for Adults with Acute Respiratory Failure

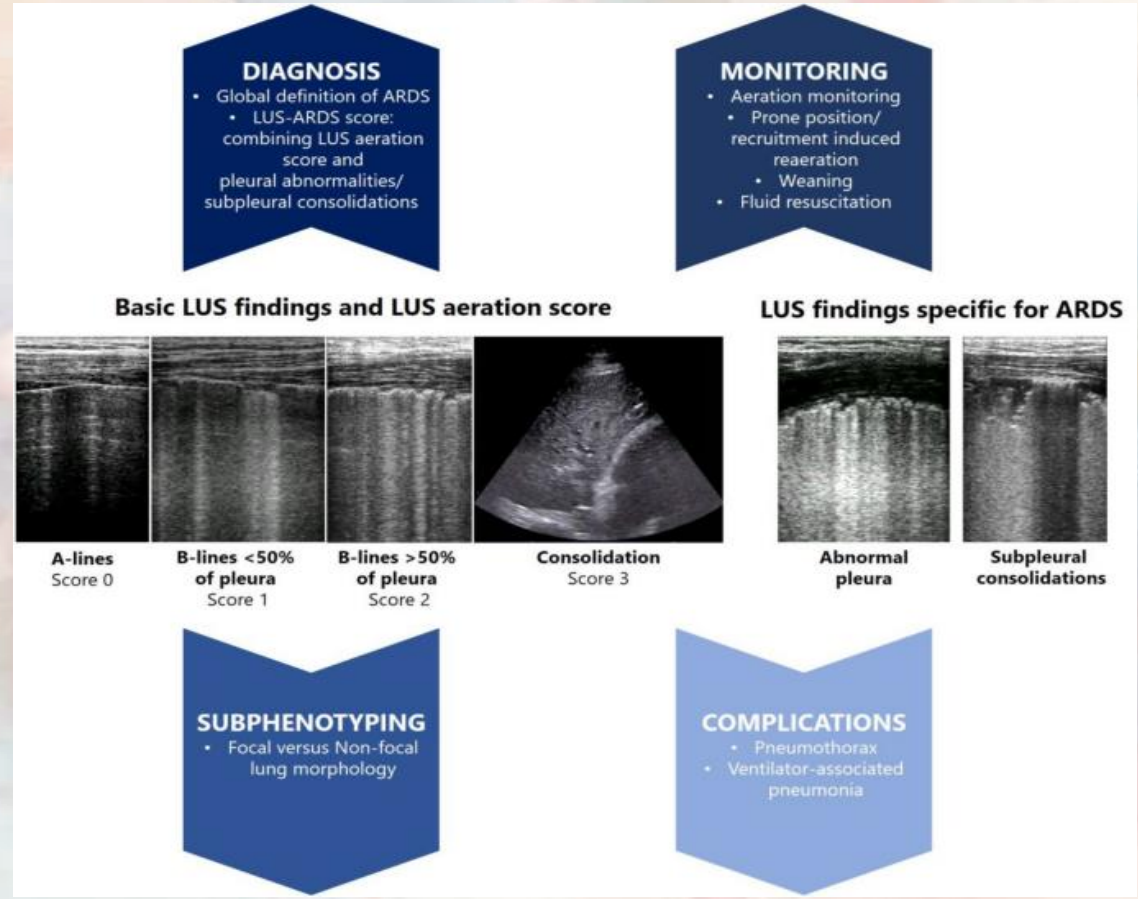
Laveena Munshi, M.D., Jordi Mancebo, M.D.,* and Laurent J. Brochard, M.D.

N ENGL J MED 387;18 NEJM.ORG NOVEMBER 3, 2022



# Lung ultrasound for diagnosis and management of ARDS

Marry R. Smit[1*], Paul H. Mayo[2] and Silvia Mongodi[3]



élargissement

# ARDS New Global Definition 2023

| new definition criteria | Classification | | |
|---|---|---|---|
| | **Mild** | **Moderate** | **Severe** |
| **Time to instalation** | Up to seven days - known risk fator(s) | | |
| **Pulmonary edema** | Not explained by cardiogenic edema or intravascular volume overload | | |
| **Radiologic features** | Bilateral infiltrates on chest X-ray or CT or lung ultrasound (by a trained professional) (not explained by nodules, pleural effusion or atelectasis) | | |
| **Hypoxemia $PaO_2/FIO_2$**** | 201-300 with NIV/CPAP PEEP ≥ 5* or HFNO > 30l/min | 101 - 200 com PEEP ≥ 5 | ≤ 100 com PEEP ≥ 5 |
| **Hypoxemia $SpO_2/FIO_2$** | ≤ 315 with $SpO_2$ ≤ 97% | | |

Am J Respir Crit Care Med 2023;207:A6229

# Mise à jour de la définition

**La nouvelle définition devrait permettre :**

- **D'identifier les patients présentant des caractéristiques conformes au cadre conceptuel convenu du SDRA,**
- **De faciliter la reconnaissance et le diagnostic rapides du SDRA pour les soins cliniques et la recherche,**
- **D'être applicable dans des contextes à ressources limitées,**
- **D'être utile pour tester des thérapies spécifiques,**
- **D'être pratique pour la communication avec les patients et les soignants**

# La « nouvelle » définition garde quelques problèmes

- **L'élargissement de la définition** → Peut diluer la sévérité de la pathologie parmi les patients ARDS
- **SPO2/ FiO2 :**
  - Pose des problèmes chez les patients choqués ou ayant une faible perfusion périphérique et chez les Hommes de couleurs
  - Plusieurs patients sont traités par O2 pour avoir une SPO2 > 97% → le rapport SPO2/FiO2 devient non informatif
- **Radiographie** garde les mêmes problèmes d'interprétation
- **Echographie** reste opérateur dépendant