ARDS: new considerations for a new definition

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Conflicts of Interest

- INSTITUTIONAL:
  - Research grants from: Draeger

- PERSONAL
  - Consultancy fee from: Draeger, Dimar, Medtronic, Flowmeter
  - Patent pending onflow generator for CPAP
  - Lecturing fees: Draeger, GE Healthcare, Getinge, Intersurgical

What is a «definition»?

✓to state or set forth the meaning of (a word, phrase, etc.)

✓to explain or identify the nature or <u>essential qualities of</u>

Challenges to Berlin definition

Brings under same Umbrella vary differnt patients (from Malaria to pancreatitis

Syndrome, not a disease!

Not sensitive/specific of DAD

Not always applicable!

Mortality is affected by many other factors!

PaO2/FiO2 depends on the conditions you measure it!

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The «kigali» definition of ARDS

	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)

Riviello, Kiviri, Twagirumugabe, *et al.*: Incidence and Outcomes of ARDS in Rwanda

Am J Respir Crit Care Med Vol 193, Iss 1, pp 52–59, Jan 1, 2016

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PEEP and stratification of outcome

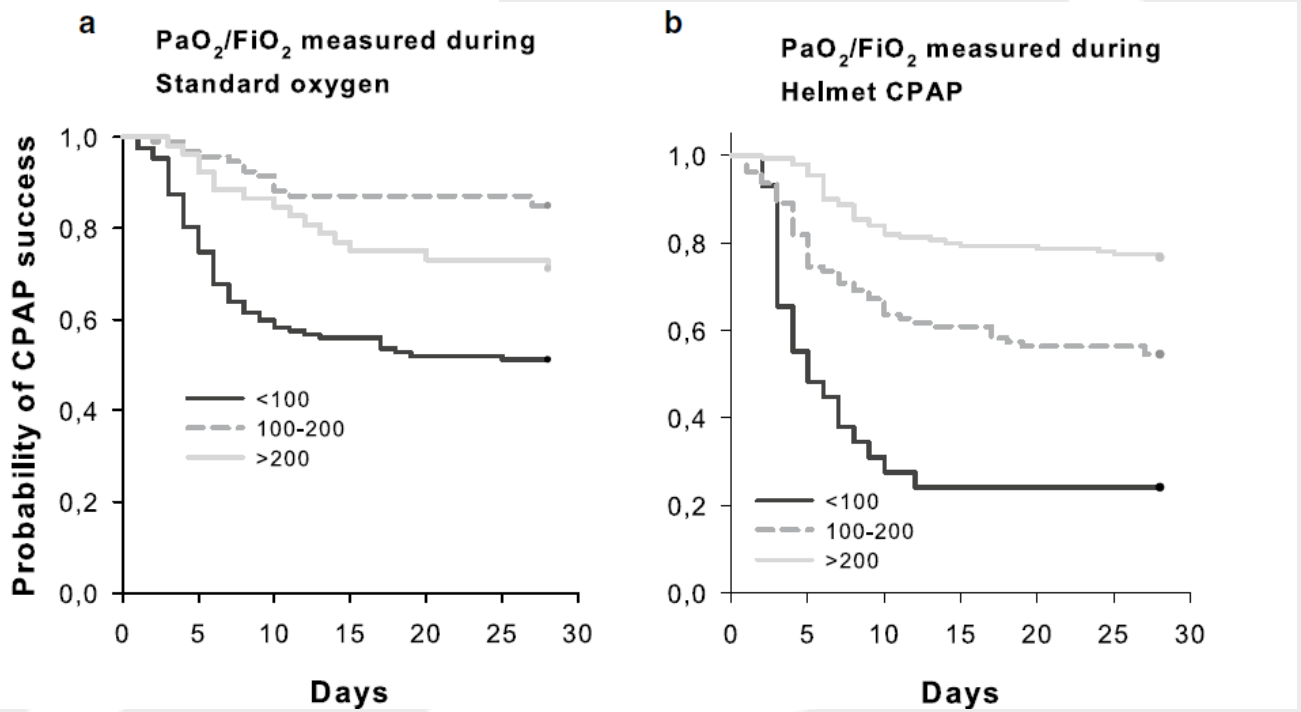
Coppadoro *et al. Crit Care* (2021) 25:80
https://doi.org/10.1186/s13054-021-03502-y

Critical Care

RESEARCH Open Access

Helmet CPAP to treat hypoxic pneumonia outside the ICU: an observational study during the COVID-19 outbreak

Andrea Coppadoro[1], Annalisa Benini[1], Robert Fruscio[1,2], Luisa Verg



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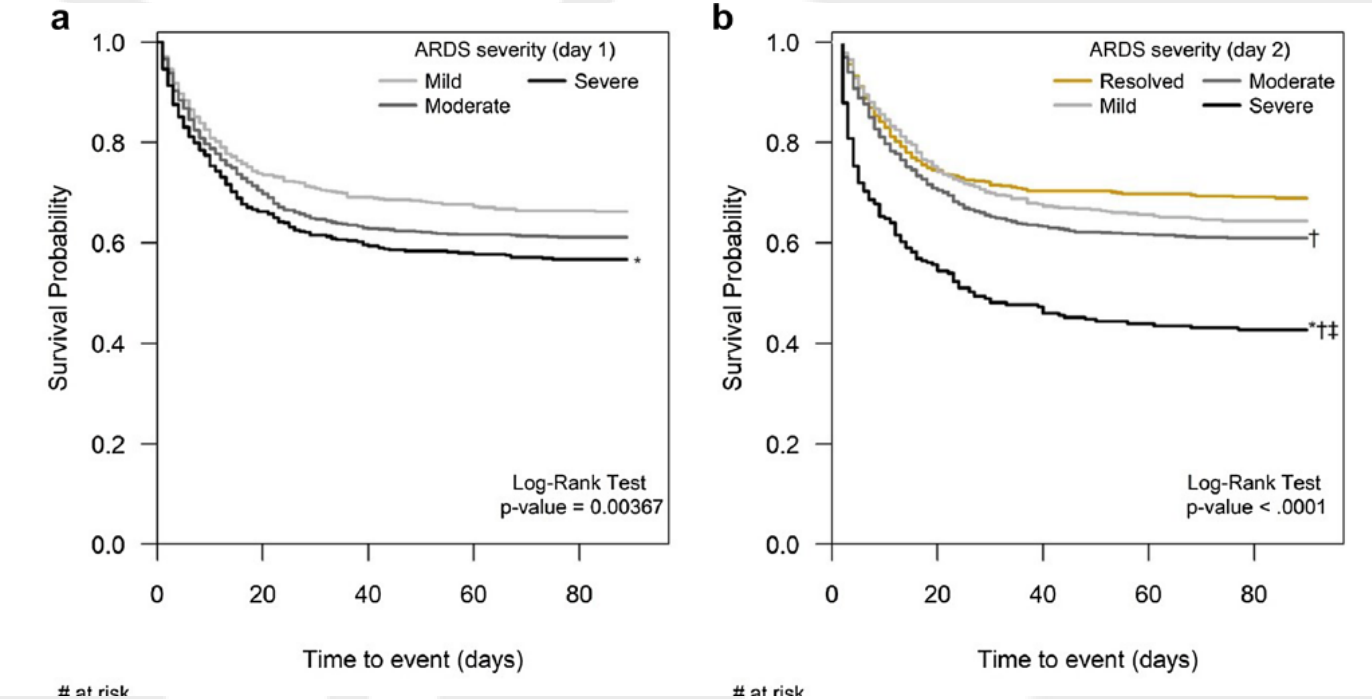
When should we diagnose ARDS?

ORIGINAL

Resolved versus confirmed ARDS after 24 h: insights from the LUNG SAFE study

Fabiana Madotto[1,2], Tài Pham[2,3,4], Giacomo Bellani[5,6], Lieuwe D. Bos[7], Fabienne D. Simonis[7], Eddy Fan[8,9], Antonio Artigas[10], Laurent Brochard[2,3,4], Marcus J. Schultz[7,11], John G. Laffey[2,3,4,12,13*] and LUNG SAFE Investigators and the ESICM Trials Group

Intensive Care Med (2018) 44:564–577
https://doi.org/10.1007/s00134-018-5152-6



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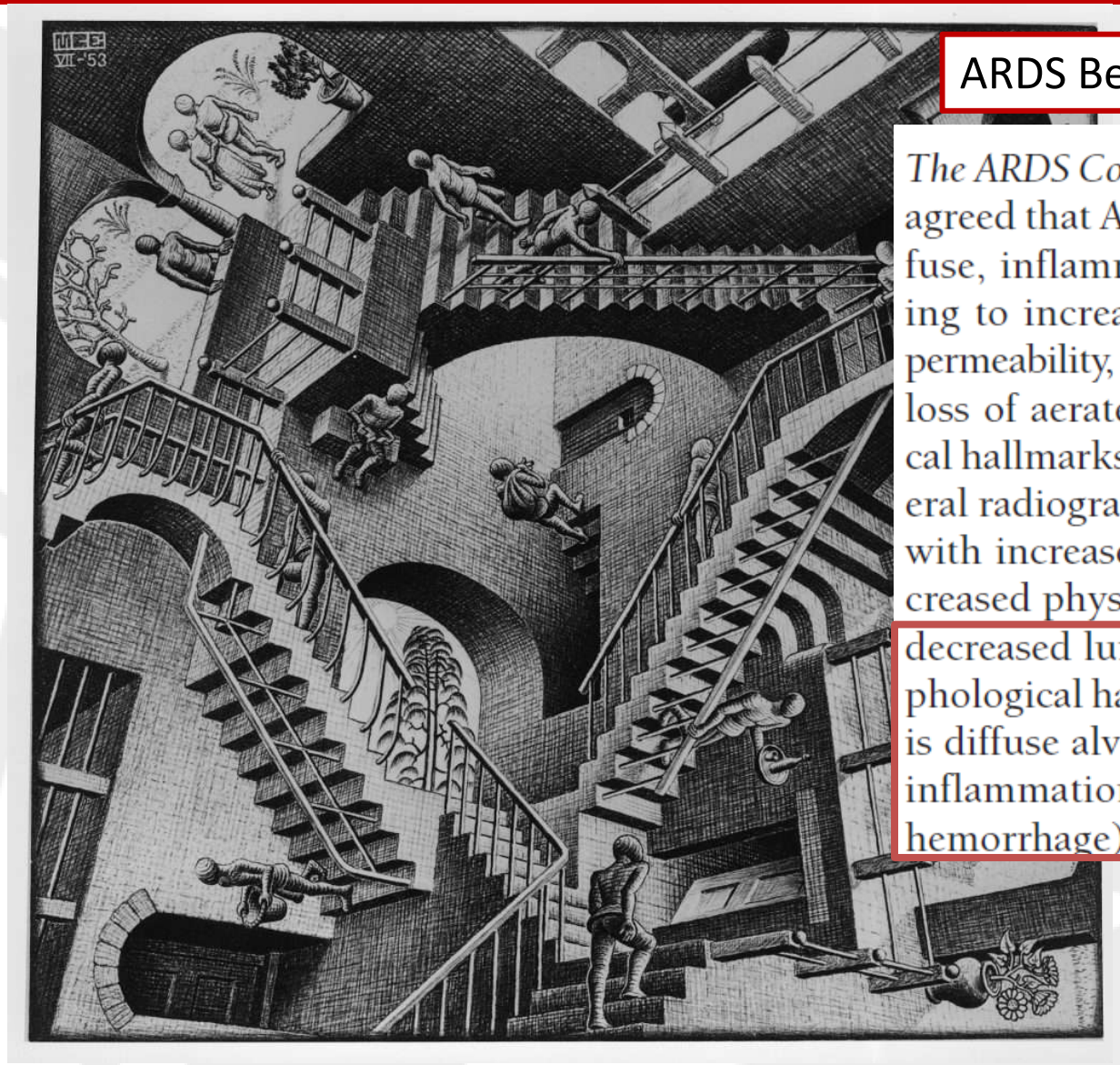
ACUTE RESPIRATORY DISTRESS SYNDROME IN ADULTS

By D.G. Ashbaugh et al. The Lancet, 1967

"THE CLINICAL PATTERN, … INCLUDES SEVERE DYSPNOEA, TACHYPNOEA, CYANOSIS THAT IS REFRACTORY TO OXYGEN THERAPY, LOSS OF LUNG COMPLIANCE, AND DIFFUSE ALVEOLAR INFILTRATION SEEN ON CHEST X-RAYS"

…to explain or identify the nature or essential qualities of….

Why are we so confused when it comes to ARDS definition?



ARDS Berlin definition

The ARDS Conceptual Model. The panel agreed that ARDS is a type of acute diffuse, inflammatory lung injury, leading to increased pulmonary vascular permeability, increased lung weight, and loss of aerated lung tissue. The clinical hallmarks are hypoxemia and bilateral radiographic opacities, associated with increased venous admixture, increased physiological dead space, and decreased lung compliance. The morphological hallmark of the acute phase is diffuse alveolar damage (ie, edema, inflammation, hyaline membrane, or hemorrhage).[29]

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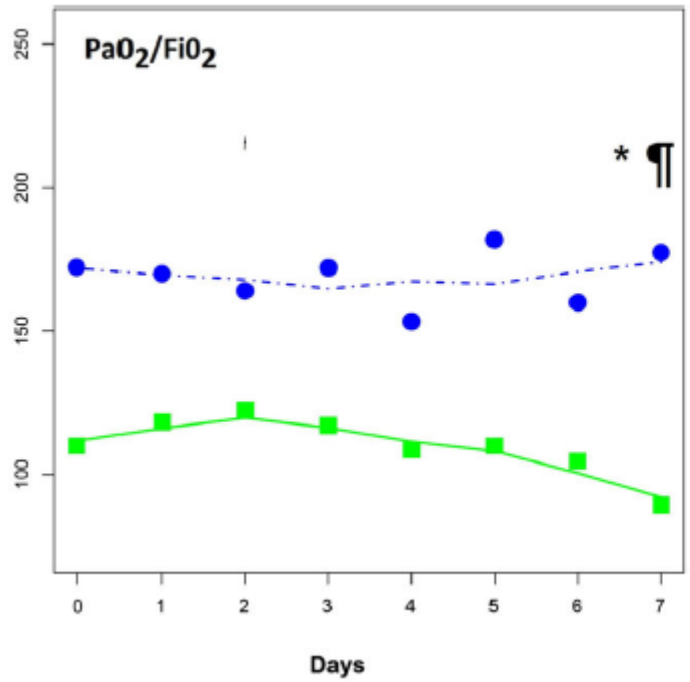
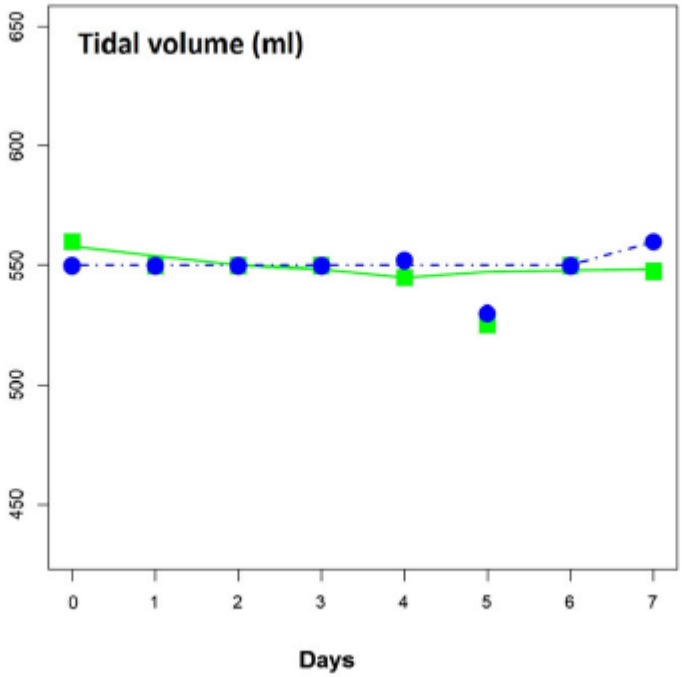
Intensive Care Med (2015) 41:1921–1930
DOI 10.1007/s00134-015-4046-0

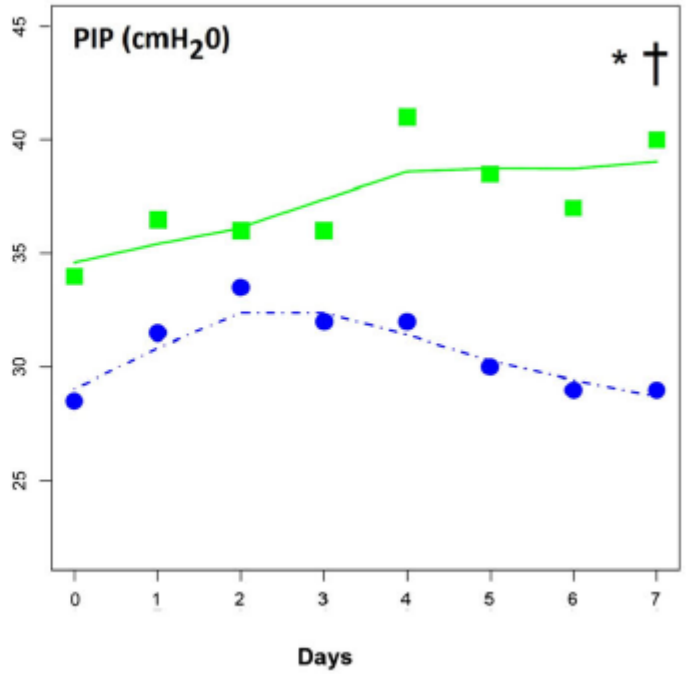
ORIGINAL

José A. Lorente
Pablo Cardinal-Fernández
Diego Muñoz
Fernando Frutos-Vivar
Arnaud W. Thille

Acute respiratory distress syndrome in patients with and without diffuse alveolar damage: an autopsy study







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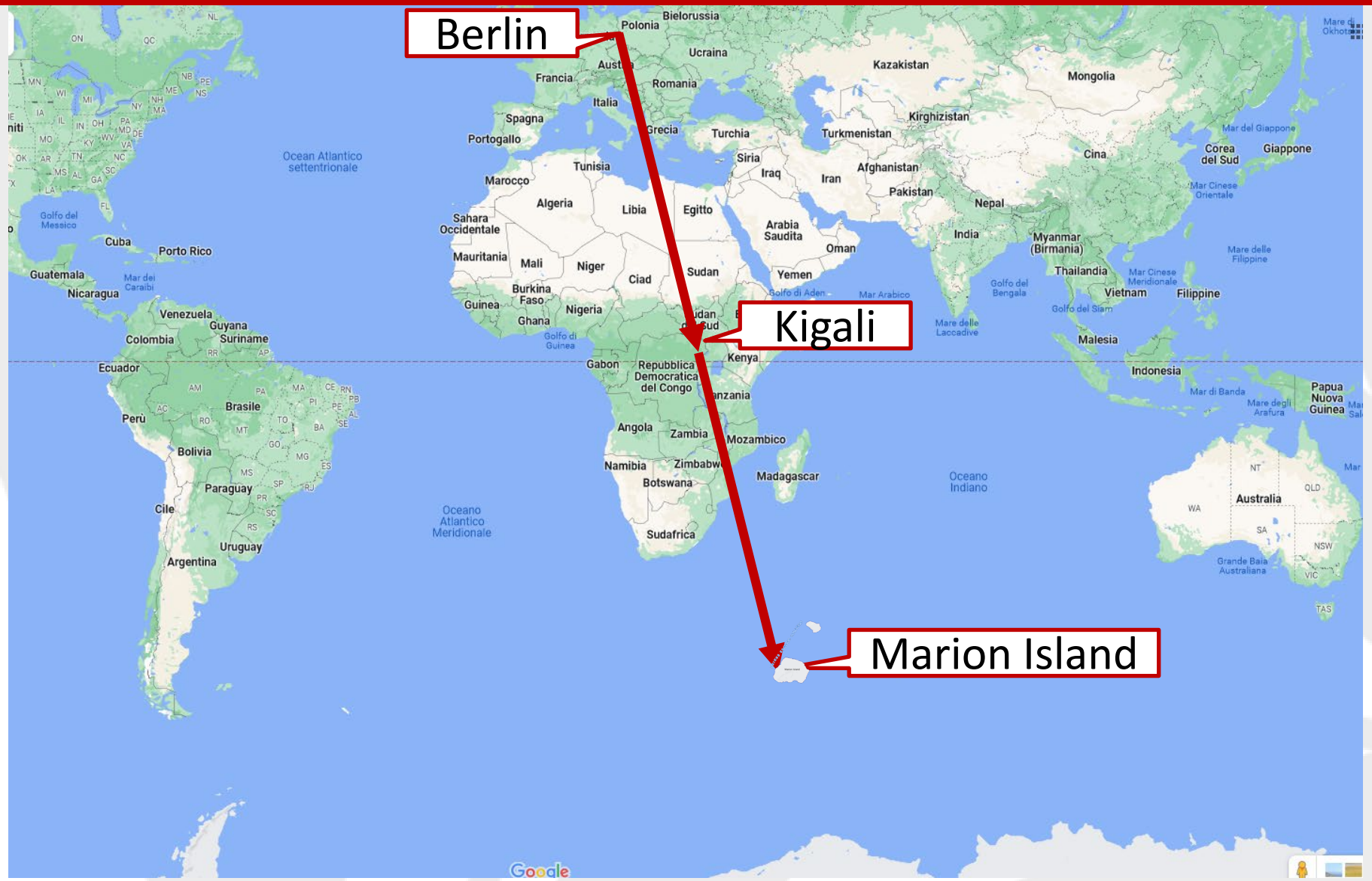
ARDS from Berlin to Kgali. Where next?



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Other «directions»?

Aggregate on “broad” clinical aspects
Hypoxaemia requiring PPV

Defined based on “biological mechanisms”

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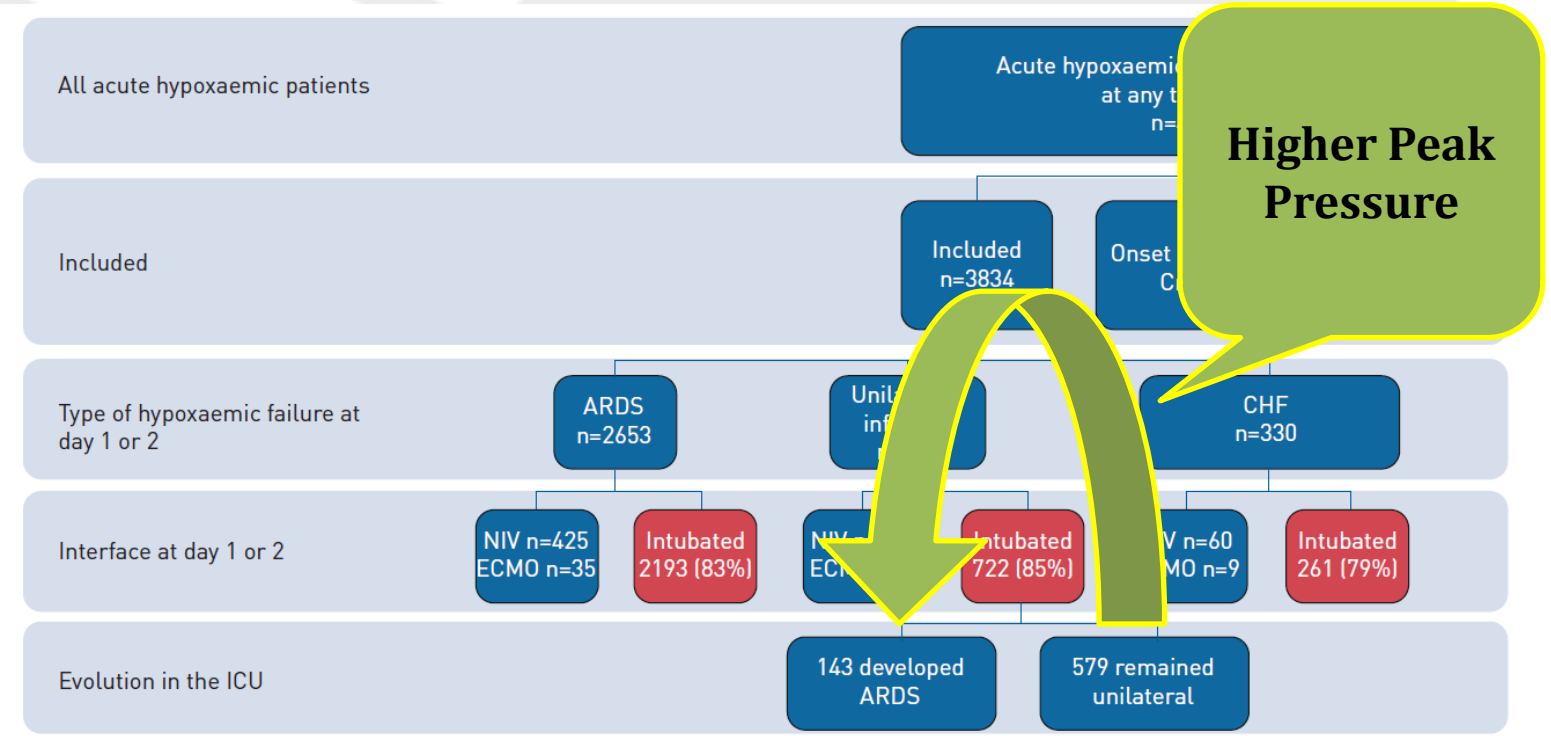
«Unilateral» respiratory failure vs ARDS («bilateral»)

Outcome of acute hypoxaemic respiratory failure: insights from the LUNG SAFE Study

Eur Respir J 2021; 57: 2003317

Tài Pham[1,2,3,4], Antonio Pesenti[5,6], Giacomo Bellani[7,8], Gordon Rubenfeld[9],



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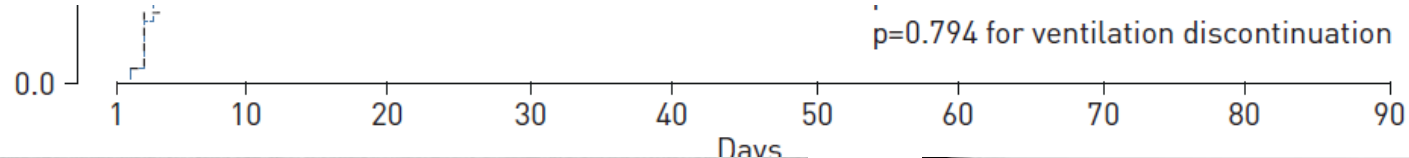
«Unilateral» respiratory failure vs ARDS («bilateral»)

No difference in severity or management

2 Quadrants-Unilateral

	Patients	Unilateral-infiltrate with two quadrants	Bilateral with two quadrants (ARDS)	p-value
Oxygenation a[illegible]				
P_{aO_2}/F_{iO_2} mm[illegible]g	1094	185±63	178±66	0.196
Mild	1094	56 (32.6)	318 (34.5)	0.509
Moderate		91 (52.9)	446 (48.4)	
Severe		25 (14.5)	158 (17.1)	
P_{aO_2} mmHg	1084	46±15	44±13	0.134
pH	1084	7.33±0.12	7.34±0.11	0.148
F_{iO_2}	1094	0.5 (0.4–0.8)	0.5 (0.4–0.7)	0.247
Tidal volume mL·kg^{-1} PBW	1046	7.6±1.8	7.8±1.7	0.153
Respiratory rate breaths·min^{-1}	1091	20±6	20±6	0.444
Minute ventilation L·min^{-1}	1071	10.33±4.50	10.31±4.62	0.942
PEEP cmH_2O	1094	6.0 (5.0–10.0)	8.0 (5.0–10.0)	0.101
Plateau pressure cmH_2O	336	20.8±5.8	21.8±5.4	0.238
Driving pressure cmH_2O	336	13.1±5.9	14.1±4.9	0.282
PIP cmH_2O	1056	25.9±8.2	25.7±8.0	0.847



Eur Respir J 2021; 57: 2003317

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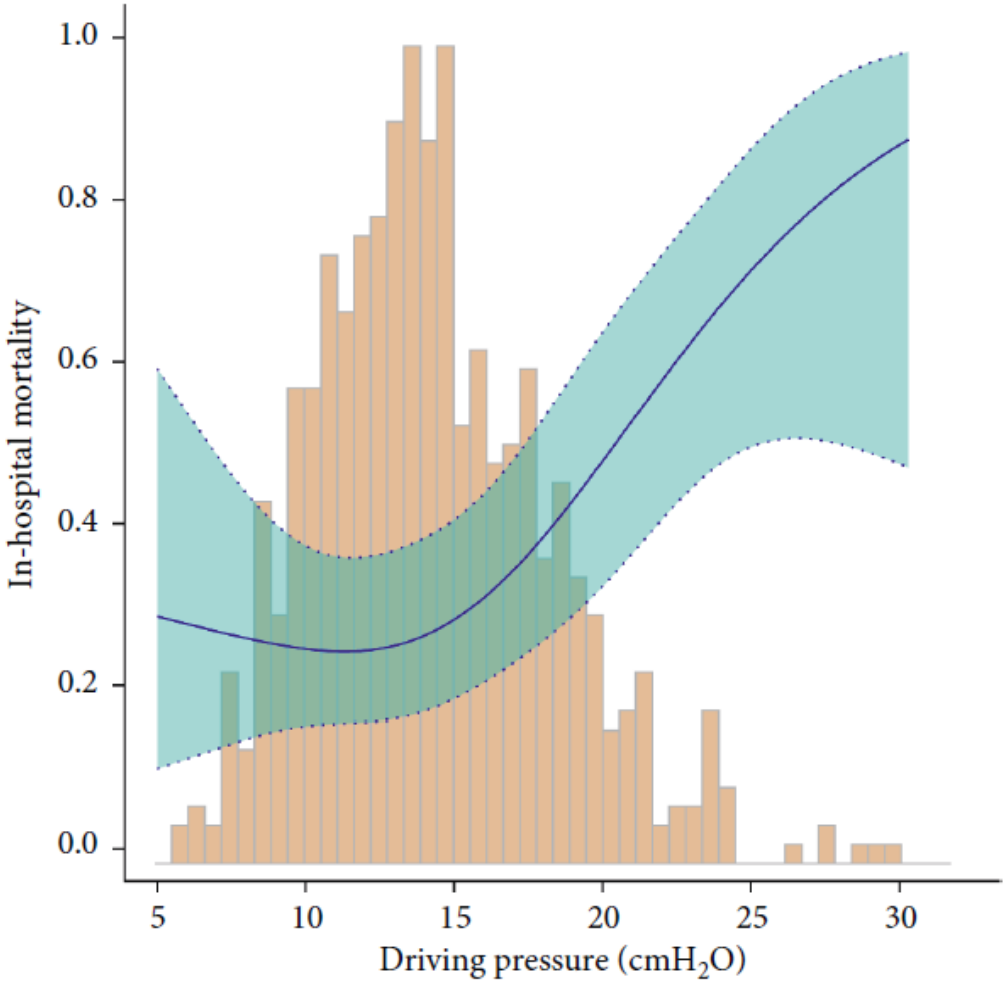
Research Article

Canadian Respiratory Journal
Volume 2021, Article ID 5574963, 8 pages

Relationship between Driving Pressure and Mortality in Ventilated Patients with Heart Failure: A Cohort Study

Qilin Yang, Jiezhao Zheng, Xiaohua Chen, Weiyan Chen, Deliang Wen,



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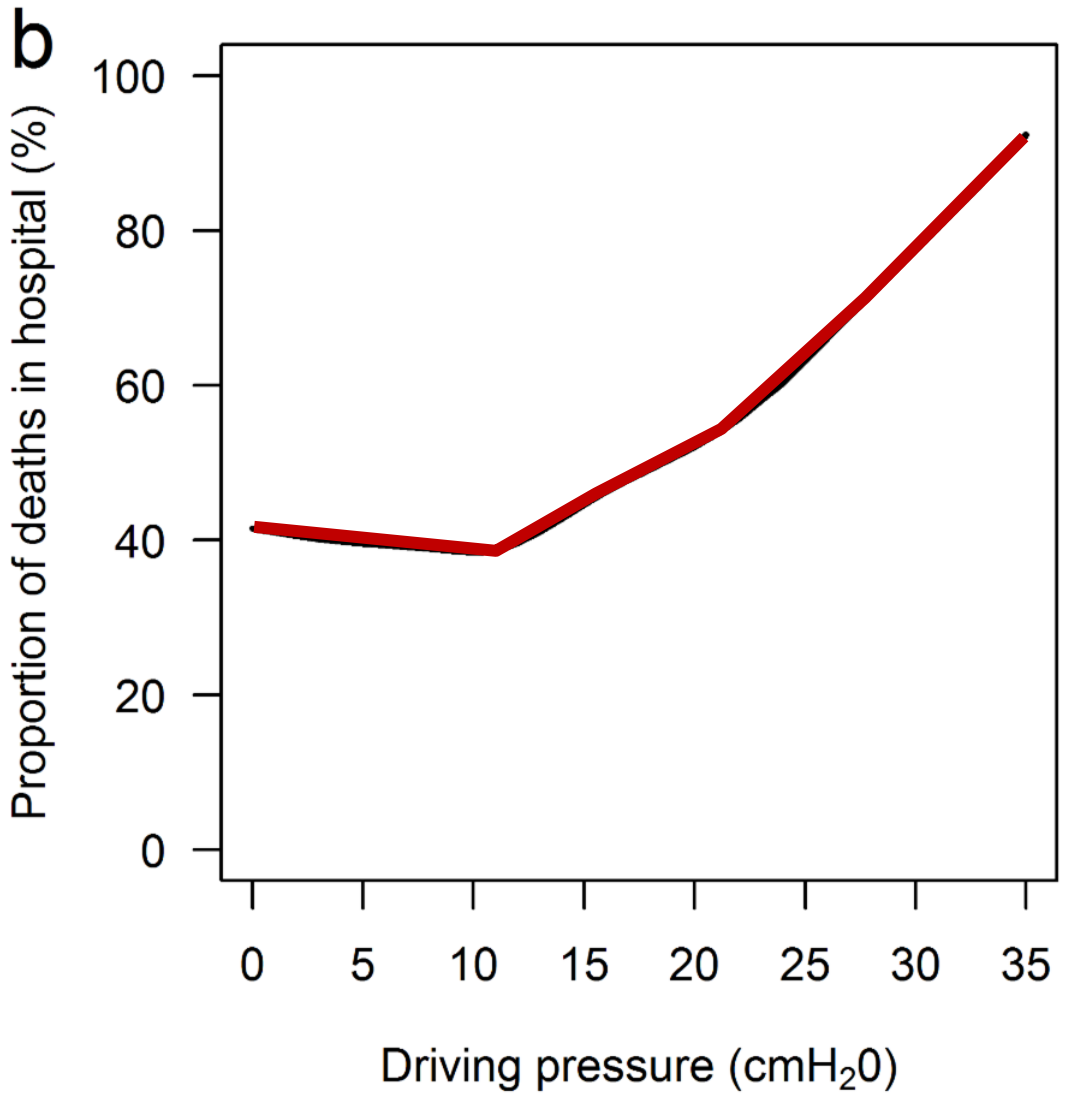
SEVEN-DAY PROFILE PUBLICATION

Potentially modifiable factors contributing to outcome from acute respiratory distress syndrome: the LUNG SAFE study

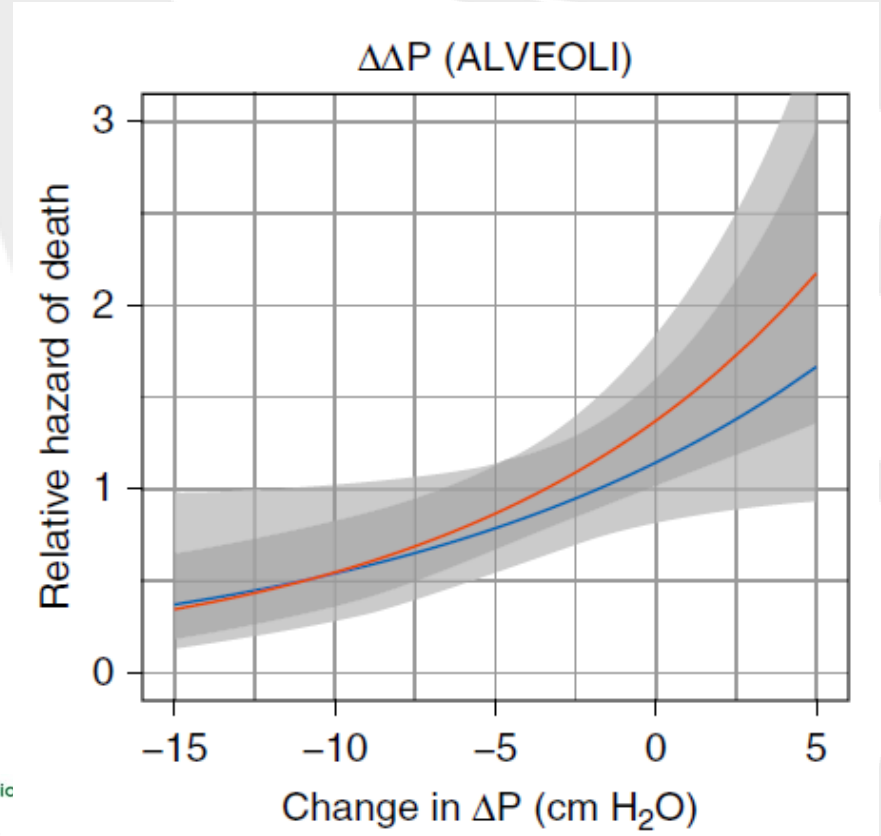
Intensive Care Med (2016) 42:1865–1876
DOI 10.1007/s00134-016-4571-5

John G. Laffey[1,2*], Giacomo Bellani[3,4], Tài Pham[5,6,7], Eddy Fan[8,9], Fabiana Madotto[10], Ednan K. Bajwa[11],



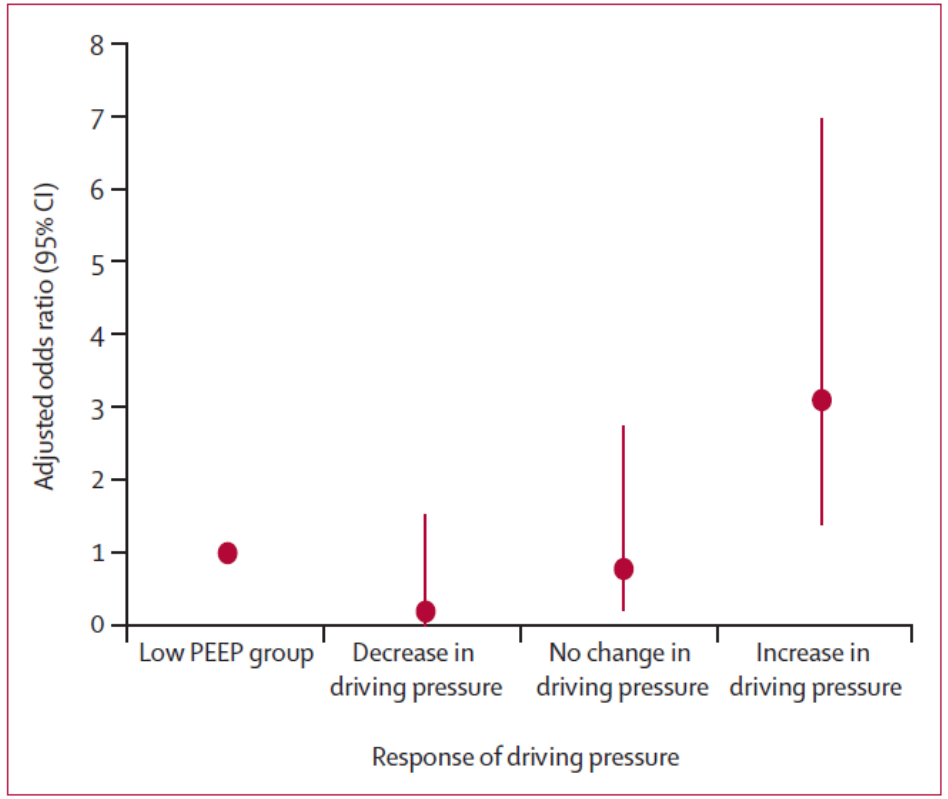
PEEP changes and mortality

Yehya N, Ann Am Thorac Soc Vol 18, No 5, pp 857–864, May 2021



Association between driving pressure and development of postoperative pulmonary complications in patients undergoing mechanical ventilation for general anaesthesia: a meta-analysis of individual patient data

Ary Serpa Neto, Sabrine N T Hemmes, Carmen S V Barbas, Martin Beiderlinden, Ana Fernandez-Bustamante , Emmanuel Futier, Ognjen Gajic, *Lancet Respir Med 2016*



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Intensive Care Med (2015) 41:1099–1102
DOI 10.1007/s00134-014-3608-x

Claude Guérin
Taylor Thompson
Roy Brower

The ten diseases that look like ARDS

Implications for treatment

If a patient with one of these ten ARDS mimics requires mechanical ventilation, there may be a substantial risk of ventilator-induced lung injury because inflammatory processes increase the vulnerability of the lung parenchyma to mechanical stress. Moreover, the volume of aerated lung is reduced, making the aerated lung vulnerable to overdistension. Therefore, we recommend using a lung-protective approach, as in ARDS, with an initial tidal volume goal of approximately 6 ml/kg predicted body weight [12]. The optimal level of positive end-expiratory

Other «directions»?

Aggregate on “broad” clinical aspects

Hypoxaemia requiring PPV

Defined based on “biological mechanisms”

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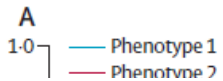
Subphenotypes in acute respiratory distress syndrome: latent class analysis of data from two randomised controlled trials

Carolyn S Calfee, Kevin Delucchi, Polly E Parsons, B Taylor Thompson, Lorraine B Ware, Michael A Matthay, and the NHLBI ARDS Network

Lancet Respir Med **2014; 2: 611–20**



	ARMA cohort			ALVEOLI cohort		
	Phenotype 1 (n=318)	Phenotype 2 (n=155)	p value	Phenotype 1 (n=404)	Phenotype 2 (n=145)	p value
Mortality (at 90 days)	23%	44%	0·006	19%	51%	<0·001
Ventilator-free days	17·8	7·7	<0·001	18·4	8·3	<0·001
Organ failure-free days	14·5	8·0	<0·001	16·5	8·4	<0·001

Values are estimated means that take into account the uncertainty of class membership.

Table 4: **Association between phenotype assignment and clinical outcomes, adjusted for degree of uncertainty regarding phenotype assignment**

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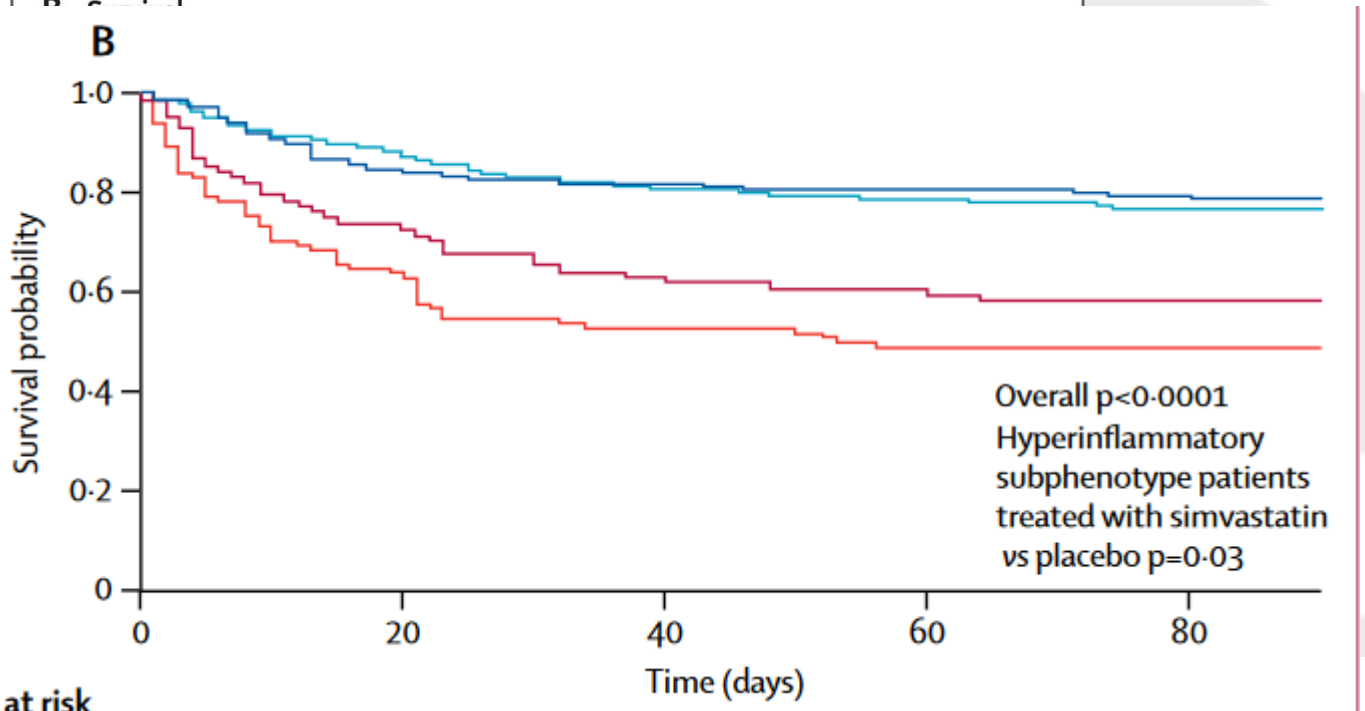
Acute respiratory distress syndrome subphenotypes and differential response to simvastatin: secondary analysis of a randomised controlled trial

Carolyn S Calfee, Kevin L Delucchi, Pratik Sinha, Michael A Matthay, Jonathan Hackett, Manu Shankar-Hari, Cliona McDowell, John G Laffey, Cecilia M O'Kane, Daniel F McAuley, on behalf of the Irish Critical Care Trials Group

Lancet Respir Med 2018; 6: 691–98



Number at risk

No. at Risk					
Simvastatin	259	238	217	208	202
Placebo	280	250	231	220	205

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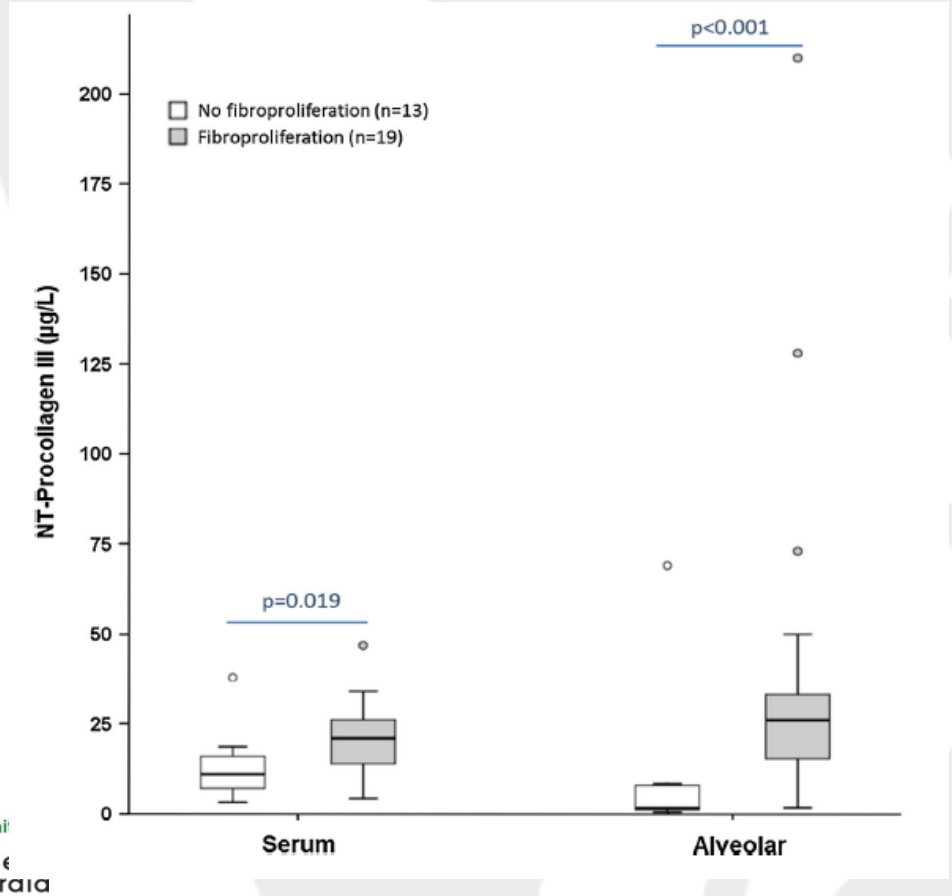
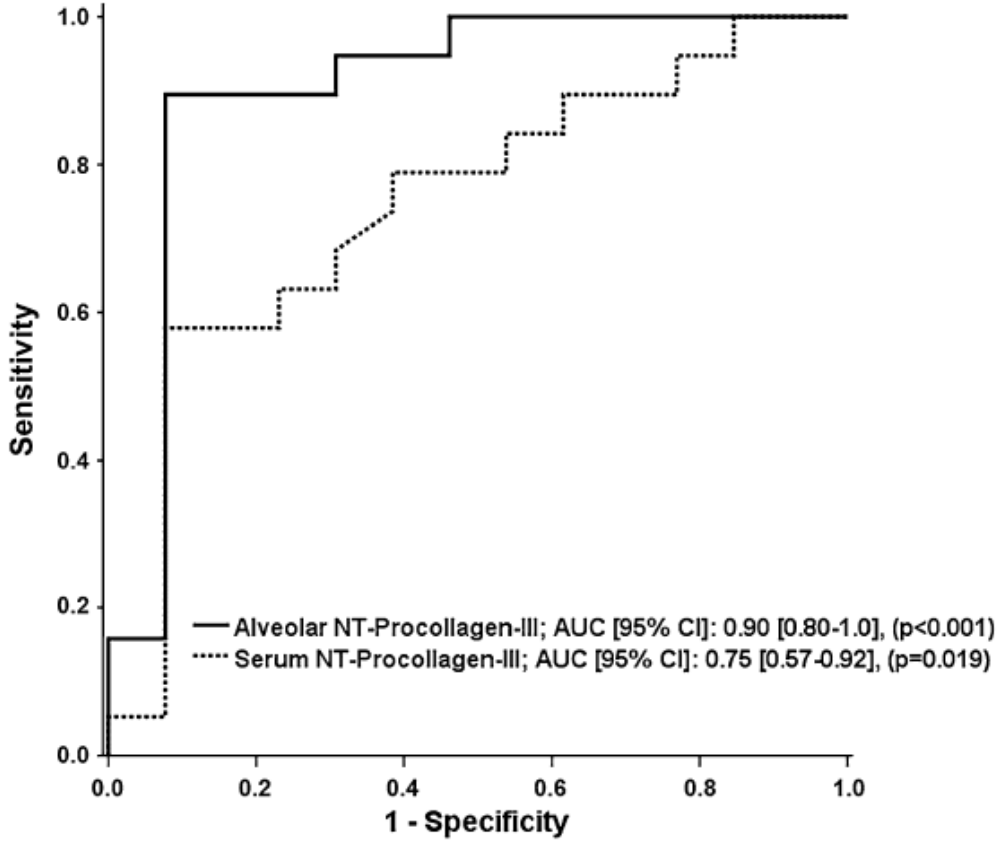
Intensive Care Med (2015) 41:1–11
DOI 10.1007/s00134-014-3524-0

ORIGINAL

Jean-Marie Forel
Christophe Guervilly
Sami Hraiech
François Voillet

Type III procollagen is a reliable marker of ARDS-associated lung fibroproliferation





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Proposal for the «Marion Island» definition….

AHRF

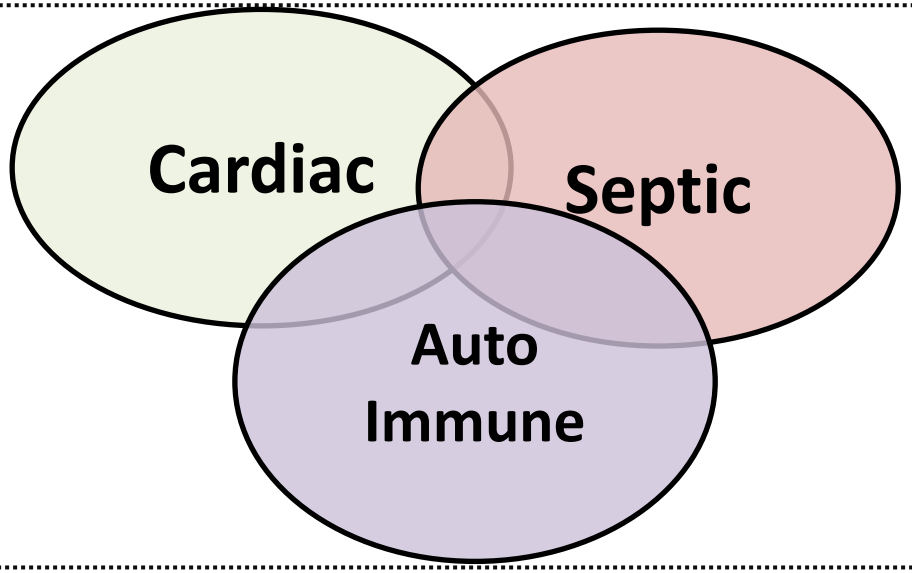
PaO2/FiO2<300
PEEP > 5
Some infiltrates

Name

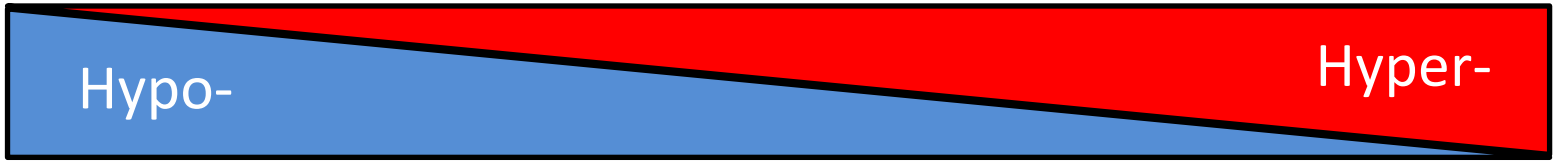
Mild	Moderate	Severe
300 mmHg	200 mmHg	120 mmHg

12/24 hrs?

Severity layer



Etiology Layer



Inflammatory Layer

Example 1: study on NIV

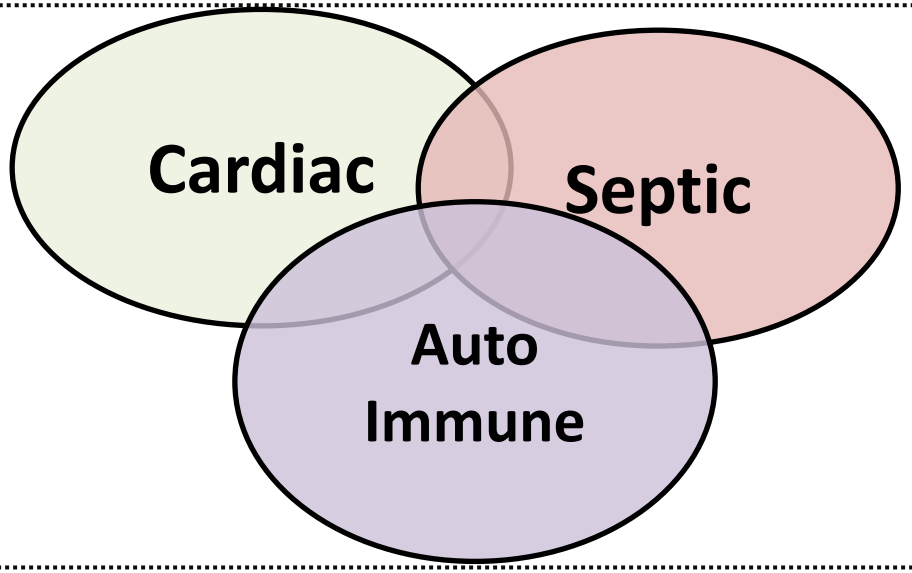
AHRF

Name

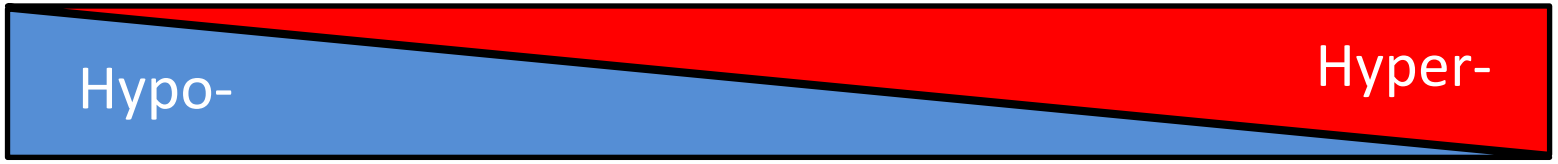
Mild | Moderate | Severe

300 mmHg | 200 mmHg | 120 mmHg

Severity layer

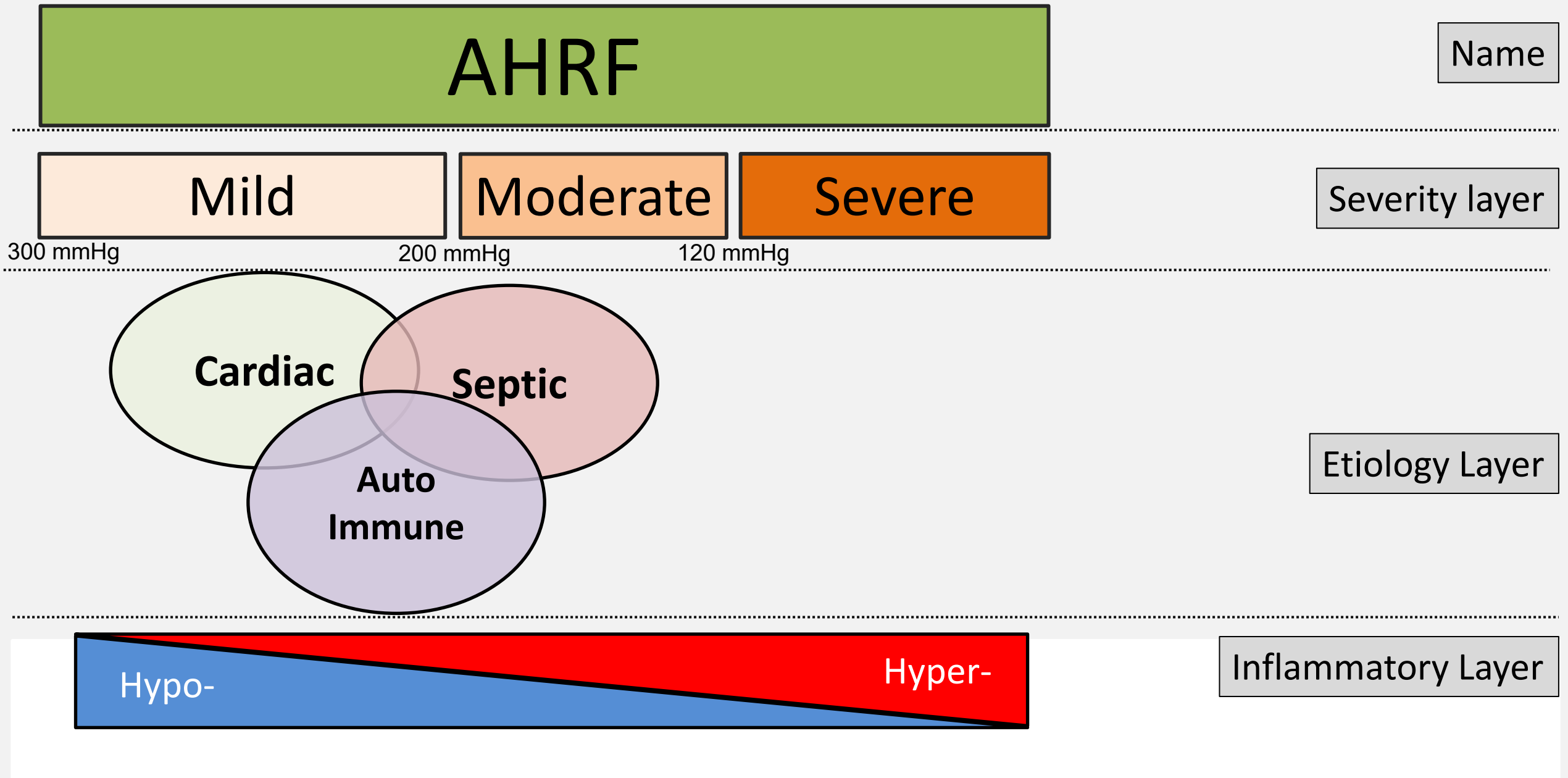


Etiology Layer



Inflammatory Layer

Example 2: study on Anti-inflammatory dug



“ARDS” since Berlin: new considerations for a new definition

- If ARDS=DAD, should we abandon the idea of diagnosing it with clinical criteria?
- Reappraise the concept of AHRF as a useful concept to study interventions beneficial to all these patients.
- Target with drugs specific biological mechanisms, identified by biomarkers?

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