Covid-ARDS Update 2020

Atul Malhotra, MD
Former President, American Thoracic Society (2015-16)
Peter C. Farrell Presidential Chair and Professor of Respiratory Medicine

Research Chief
Pulmonary Critical Care Sleep Medicine and Physiology UC San Diego

Ventilator Quick Tips

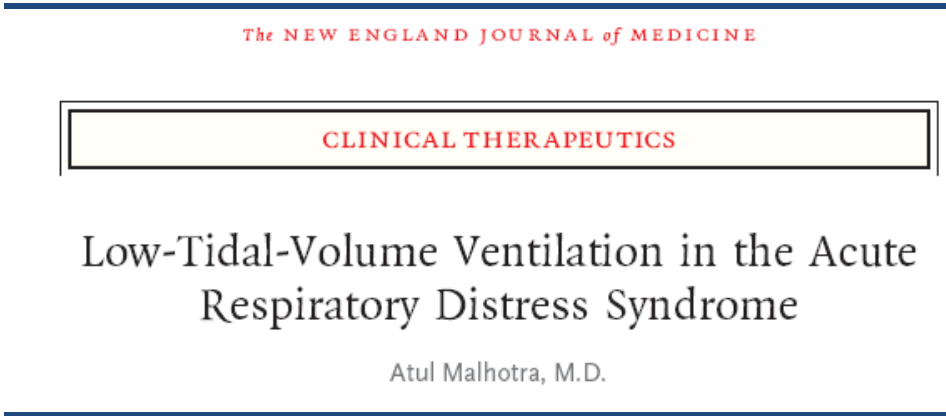
1. For hypoxemia you can increase PEEP or increase FIO2 but address underlying causes

2. For hypercapnia you can increase RR or Vt (or applied pressure) but consider your goal PaCO2

Notes:
ALWAYS look for underlying causes
Check lots of blood gases if available
Consider off target effects e.g. PEEP can reduce preload and afterload,
In general as a beginner make small changes and see what they do

Take Home Messages

- 1. Low tidal volume mechanical ventilation is standard of care in ARDS
- 2. Low driving pressure is useful but not in isolation
- 3. Patients with Covid ARDS are quite recruitable in some cases
- 4. prone positioning has mortality benefit in ARDS with LTV
- 5. there are no proven therapies for CovidARDS and off label has risk

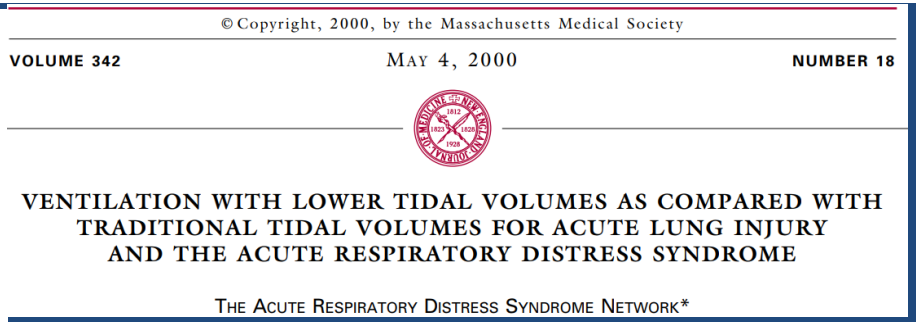


The NEW ENGLAND JOURNAL of MEDICINE

CLINICAL THERAPEUTICS

Low-Tidal-Volume Ventilation in the Acute Respiratory Distress Syndrome

Atul Malhotra, M.D.



VOLUME 342 MAY 4, 2000 NUMBER 18

VENTILATION WITH LOWER TIDAL VOLUMES AS COMPARED WITH TRADITIONAL TIDAL VOLUMES FOR ACUTE LUNG INJURY AND THE ACUTE RESPIRATORY DISTRESS SYNDROME

THE ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK*

ARDSNET

6 cc/kg ideal body weight

40% vs. 30% mortality comparing 12 cc/kg vs. 6cc/kg

Lower is better

Goal is to do no mechanical harm with ventilator

NEJM 9/07

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Driving Pressure and Respiratory Mechanics in ARDS

Stephen H. Loring, M.D., and Atul Malhotra, M.D.

- Plateau pressure minus PEEP predicts mortality in lots of different trials
- The trials were designed for the most part to fix tidal volume so the lack of predictive value of Vt is not surprising (i.e. the number 6)
- Amato report corroborated by LungSafe study (Crouch, Bates JAMA)

SPECIAL ARTICLE

Driving Pressure and Survival in the Acute Respiratory Distress Syndrome

Marcelo B.P. Amato, M.D., Maureen O. Meade, M.D., Arthur S. Slutsky, M.D., Laurent Brochard, M.D., Eduardo L.V. Costa, M.D., David A. Schoenfeld, Ph.D., Thomas E. Stewart, M.D., Matthias Briel, M.D., Daniel Talmor, M.D., M.P.H., Alain Mercat, M.D., Jean-Christophe M. Richard, M.D., Carlos R.R. Carvalho, M.D., and Roy G. Brower, M.D.

NEJM 2015

Driving Pressure for Ventilation of Patients with Acute Respiratory Distress Syndrome

Angela Meier, M.D., Ph.D., Rebecca E. Sell, M.D., Atul Malhotra, M.D.

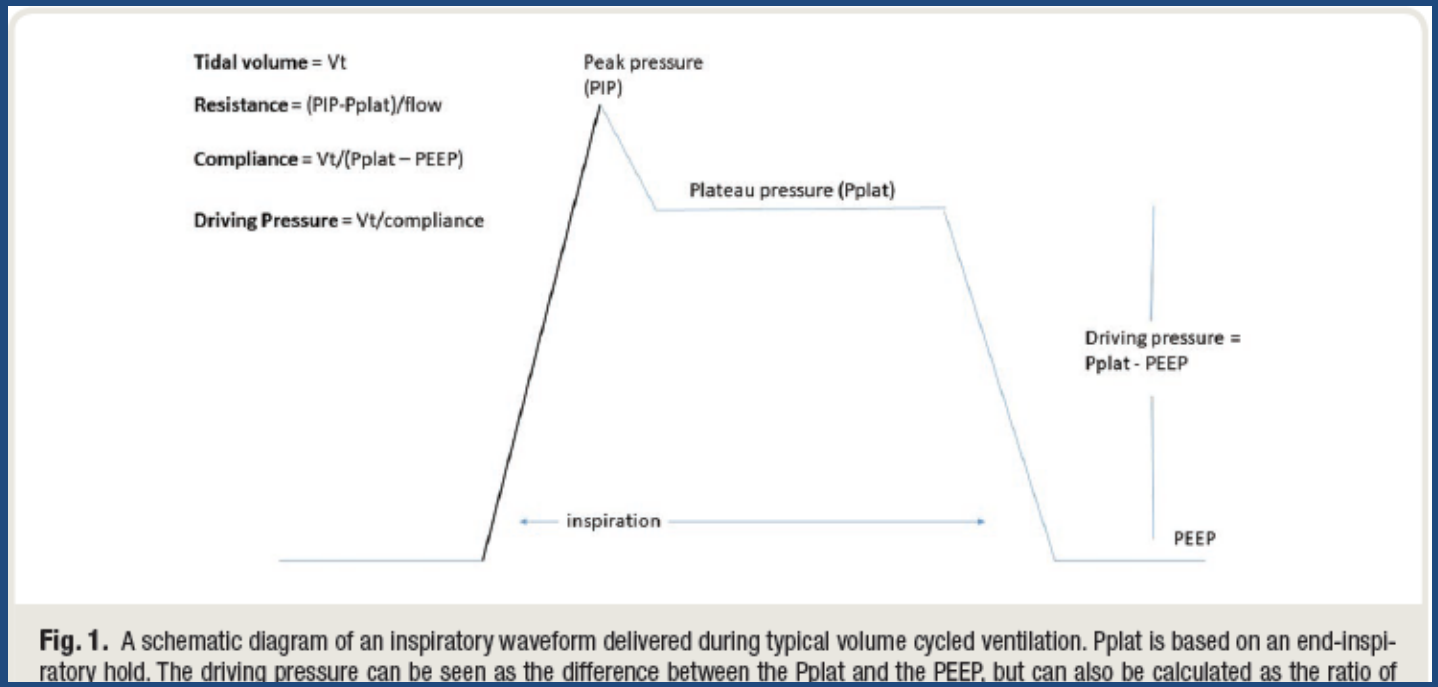

Fig. 1. A schematic diagram of an inspiratory waveform delivered during typical volume cycled ventilation. Pplat is based on an end-inspiratory hold. The driving pressure can be seen as the difference between the Pplat and the PEEP, but can also be calculated as the ratio of

Anesthesiology 2020 in press

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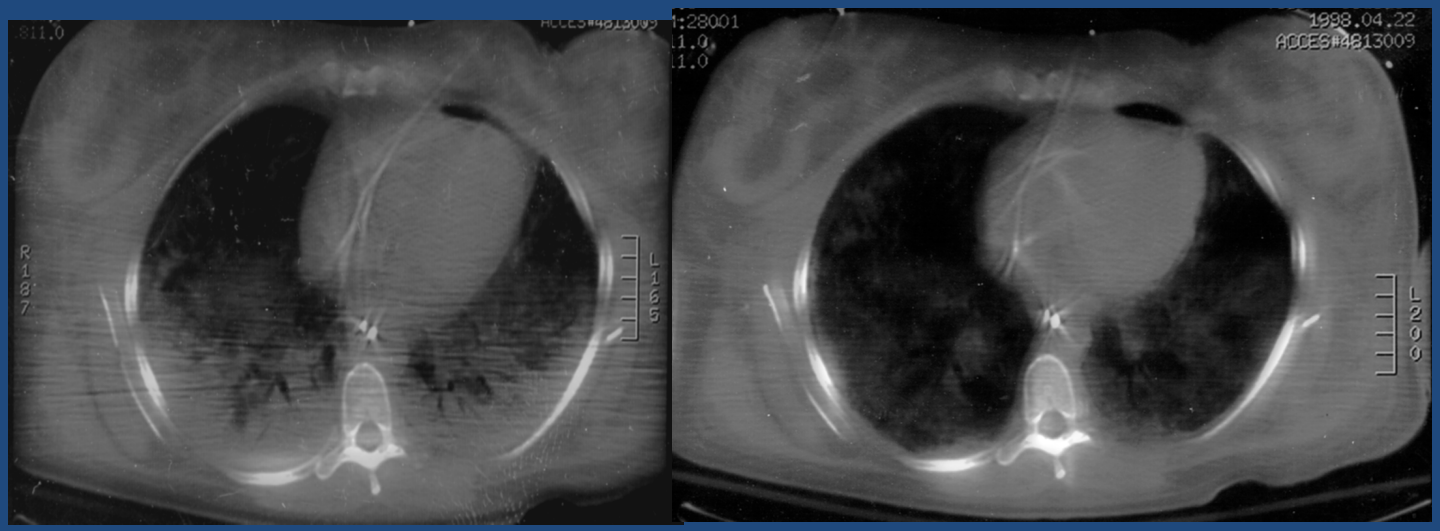
Cytokine Release Following Recruitment Maneuvers*

Daniel Talmor, MD, MPH, FCCP; Todd Sarge, MD; Anna Legedza, ScD; Carl R. O'Donnell, ScD; Ray Ritz, RRT; Stephen H. Loring, MD; and Atul Malhotra, MD, FCCP

- Homogeneous lung may help to reduce shear forces which occur at junctions of normal and abnormal lung



Before recruitment

After recruitment

Crit Care Med 2000, Chest 2007

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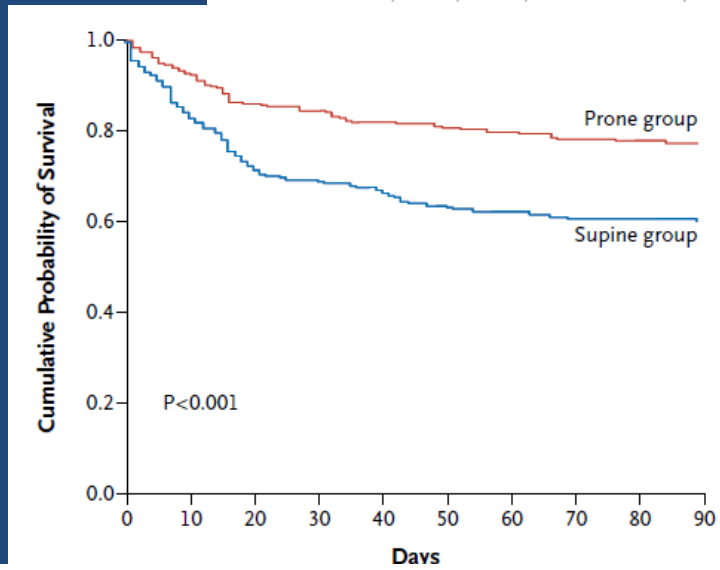
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 6, 2013 VOL. 368 NO. 23

Prone Positioning in Severe Acute Respiratory Distress Syndrome

Claude Guérin, M.D., Ph.D., Jean Reignier, M.D., Ph.D., Jean-Christophe Richard, M.D., Ph.D., Pascal Beuret, M.D., Arnaud Gacouin, M.D., Thierry Boulain, M.D., Emmanuelle Mercier, M.D., Michel Badet, M.D., Alain Mercat, M.D., Ph.D., Olivier Baudin, M.D., Marc Clavel, M.D., Delphine Chatellier, M.D., Samir Jaber, M.D., Ph.D., ɔ, M.D., Ph.D., Michel Sirodot, M.D., Gilles Hilbert, M.D., Ph.D., ɒeur, M.D., Marc Gainnier, M.D., Ph.D., Frédérique Bayle, M.D., Raphaele Girard, M.D., Loredana Baboi, Ph.D., and Louis Ayzac, M.D., r the PROSEVA Study Group*



JTD 2018
Chest 2017

Prone positioning in acute respiratory distress syndrome: why aren't we using it more?

Mark L. Hepokoski, Mazen Odish, Atul Malhotra

[Contemporary Reviews in Critical Care Medicine]

CHEST

Treatment of ARDS With Prone Positioning

CrossMark

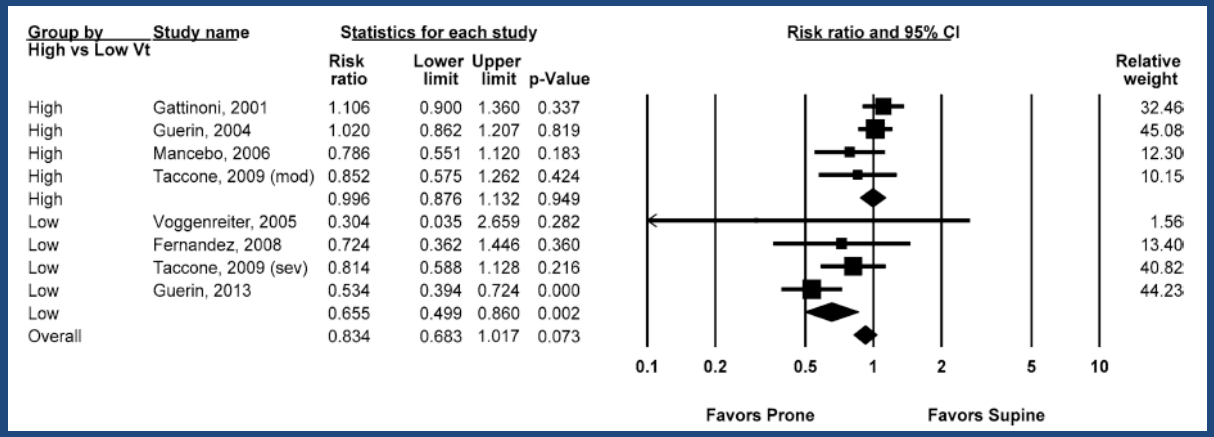
Eric L. Scholten, MD; Jeremy R. Beitler, MD, MPH; G. Kim Prisk, PhD, DSc; and Atul Malhotra, MD

Intensive Care Med (2014) 40:332–341
DOI 10.1007/s00134-013-3194-3

SYSTEMATIC REVIEW

Jeremy R. Beitler
Shahzad Shaefi
Sydney B. Montesi
Amy Devlin
Stephen H. Loring
Daniel Talmor
Atul Malhotra

Prone positioning reduces mortality from acute respiratory distress syndrome in the low tidal volume era: a meta-analysis



Group by High vs Low Vt	Study name	Risk ratio	Lower limit	Upper limit	p-Value	Relative weight
High	Gattinoni, 2001	1.106	0.900	1.360	0.337	32.46
High	Guerin, 2004	1.020	0.862	1.207	0.819	45.08
High	Mancebo, 2006	0.786	0.551	1.120	0.183	12.30
High	Taccone, 2009 (mod)	0.852	0.575	1.262	0.424	10.15
High		0.996	0.876	1.132	0.949	
Low	Voggenreiter, 2005	0.304	0.035	2.659	0.282	1.56
Low	Fernandez, 2008	0.724	0.362	1.446	0.360	13.40
Low	Taccone, 2009 (sev)	0.814	0.588	1.128	0.216	40.82
Low	Guerin, 2013	0.534	0.394	0.724	0.000	44.23
Low		0.655	0.499	0.860	0.002	
Overall		0.834	0.683	1.017	0.073	

Prone benefits seen primarily with open lung protective ventilation

Covid patients look responsive (AJRCCM In press)

VIEWPOINT Open Access

PEEP titration during prone positioning for acute respiratory distress syndrome

Jeremy R. Beitler[1*], Claude Guérin[2,3], Louis Ayzac[4], Jordi Mancebo[5], Dina M. Bates[1], Atul Malhotra[1] and Daniel Talmor[6]

ICM 2014, Crit Care 2015

The NEW ENGLAND JOURNAL of MEDICINE

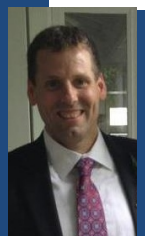
ESTABLISHED IN 1812 MAY 24, 2018 VOL. 378 NO. 21

Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome

A. Combes, D. Hajage, G. Capellier, A. Demoule, S. Lavoué, C. Guervilly, D. Da Silva, L. Zafrani, P. Tirot, B. Veber, E. Maury, B. Levy, Y. Cohen, C. Richard, P. Kalfon, L. Bouadma, H. Mehdaoui, G. Beduneau, G. Lebreton, L. Brochard, N.D. Ferguson, E. Fan, A.S. Slutsky, D. Brodie, and A. Mercat, for the EOLIA Trial Group, REVA, and ECMONet*

ECMO for Severe ARDS

C. Corey Hardin, M.D., Ph.D., and Kathryn Hibbert, M.D.



CONCLUSIONS

Among patients with very severe ARDS, 60-day mortality was not significantly lower with ECMO than with a strategy of conventional mechanical ventilation that included ECMO as rescue therapy. (Funded by the Direction de la Recherche Clinique et du Développement and the French Ministry of Health; EOLIA ClinicalTrials.gov number, NCT01470703.)

Table 2. End Points.*

End Point	ECMO Group (N=124)	Control Group (N=125)	Relative Risk or Difference (95% CI)†	P Value
Primary end point: mortality at 60 days — no. (%)	44 (35)	57 (46)	0.76 (0.55 to 1.04)	0.09
Key secondary end point: treatment failure at 60 days — no. (%)‡	44 (35)	72 (58)	0.62 (0.47 to 0.82)	<0.001
Other end points				
Mortality at 90 days — no. (%)	46 (37)	59 (47)	−10 (−22 to 2)	
Median length of stay (interquartile range) — days				
In the ICU	23 (13–34)	18 (8–33)	5 (−1 to 10)	
In the hospital	36 (19–48)	18 (5–43)	18 (6 to 25)	

Take Home
ECMO might work
We are using the same indications for non-Covid ARDS

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ORIGINAL ARTICLE

Exhaled air dispersion and removal is influenced by isolation room size and ventilation settings during oxygen delivery via nasal cannula

DAVID S. HUI,[1,2] BENNY K. CHOW,[3] LEO CHU,[4] SUSANNA S. NG,[2] SIK-TO LAI,[5] TONY GIN[4] MATTHEW T.V. CHAN[4]

[1]*Stanley Ho Center for Emerging Infectious Diseases, Departments of* [2]*Medicine and Therapeu* [3]*Architecture and* [4]*Anaesthesia and Intensive Care, The Chinese University of Hong Kong, and* [5]*Dep Medicine and Geriatrics, Princess Margaret Hospital, Hong Kong, China*

Respirology 2011

Increasing nasal cannula oxygen increasing from 1lpm to 5lpm increases dispersion to 1 meter

Even nasal cannula is not “safe”

This was simulator so maybe worse with coughing human

PPE for safety

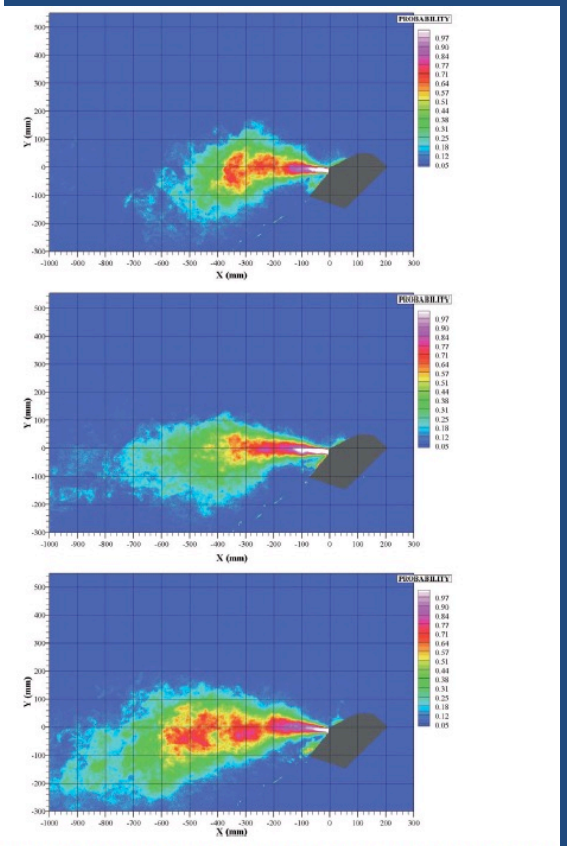


Figure 3 Exhaled air dispersion distances during application of oxygen at 1 L/min (top image), 3 L/min (middle image) and 5 L/min (bottom image) to the human-patient simulator with mild lung injury in the larger isolation room with more efficient air exchange.

Provider factors i.e. PPE may be more important than patient factors for preventing infection

Recommendation:

25. For adults with COVID-19 and **acute hypoxemic respiratory failure** despite conventional oxygen therapy, we **suggest using** HFNC over conventional oxygen therapy (weak recommendation, low quality evidence).

Recommendation:

26. In adults with COVID-19 and **acute hypoxemic respiratory failure**, we **suggest** using HFNC over NIPPV (weak recommendation, low quality evidence).

For me personally I recommend nasal cannula or intubate ideally

HFNC during SARS was compared to open face mask; sprays droplets

During MERS NIV failed and led to contamination

In general NIV for viral pneumonia does not work well

Risk of contamination in a coughing patient even with a 'good seal'

<u>However, nasal cannula also spreads so the PPE is more important than patient factors</u>

Take Home

I am now comfortable using HFNC and NIV in Covid patients with the providers have adequate protection

Risk of Using off label drugs

1. Medications have side effects
2. We will never learn the truth
3. Malaria and other Plasmodia kill 500K per year which was a considerable improvement over last 20 years

    supplies of chloroquine and hydroxychloroquine are depleted

    I predict/fear more people will die of malaria spike than Covid

UCSD PCCSM discourages off label drug use

Should We Give Steroids for Covid-ARDS?

Recommendations

41. In mechanically ventilated adults with COVID-19 and respiratory failure (**without ARDS**), we **suggest against** the routine use of systemic corticosteroids (weak recommendation, low quality evidence).

42. In mechanically ventilated adults with COVID-19 **and ARDS**, we suggest using systemic corticosteroids, over not using corticosteroids (weak recommendation, low quality evidence).

Caveats with steroids in Covid-ARDS:

1. The Dexa-ARDS (LRM 2020) did not complete enrollment after 5-6 years
2. Varying etiologies of ARDS may respond differently ; studies have variable results
3. Chinese reports of tetraplegic myopathy and superinfection (?)
4. We are seeing 20% coinfections as opposed to 2-3% from Wuhan; bad outcomes w/ H1N1
5. We are not bronching re: superinfections (Meduri) ; lymphopenia
6. Controversy with steroid use in myocarditis

Dexamethasone treatment for the acute respiratory distress syndrome: a multicentre, randomised controlled trial

*Jesús Villar, Carlos Ferrando, Domingo Martínez, Alfonso Ambrós, Tomás Muñoz, Juan A Soler, Gerardo Aguilar, Francisco Alba, Elena González-Higueras, Luís A Conesa, Carmen Martín-Rodríguez, Francisco J Díaz-Domínguez, Pablo Serna-Grande, Rosana Rivas, José Ferreres, Javier Belda, Lucía Capilla, Alec Tallet, José M Añón, Rosa L Fernández, Jesús M González-Martín for the dexamethasone in ARDS network**

Summary

Background There is no proven specific pharmacological treatment for patients with the acute respiratory distress

Lancet Respir Med 2020

Dr. Cao: for rescue of Covid-ARDS consider 1-2 mg/kg methlypred for 4-5 days

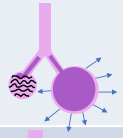
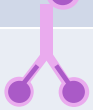
Conclusions

1. Good critical care is here to stay
2. There are no proven therapies for Covid 19
3. Stay calm and wash your hands

Driving Pressure for Ventilation of Patients with Acute Respiratory Distress Syndrome

Angela Meier, M.D., Ph.D., Rebecca E. Sell, M.D., Atul Malhotra, M.D.

How can we lower driving pressure: increase PEEP or reduce plateau

Lung Pathology/Physiology	Strategy to Decrease Driving Pressure	Result
Compressed, recruitable alveoli (for example fluid) 	Increase PEEP	👌 Normally expanded, optimized alveoli 
Compressed, non-recruitable alveoli (for example fluid) 	Increase PEEP	Collapsed and overdistended alveoli 
Optimized alveoli 	Decrease Plateau Pressure (decrease TV)	Underfilled alveoli 
Overdistended alveoli 	Decrease Plateau Pressure (decrease TV)	👌 Normally expanded, optimized alveoli 

Take Home: do not use driving pressure in isolation

Anesthesiology 2020