



AVDS & COVID-19

Pr Vincent JOUNIEAUX
Service de Pneumologie & Soins continus respiratoires
CHU Amiens-Picardie

Déclaration d'intérêts

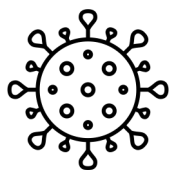
RÉMUNÉRATION ET AVANTAGES À TITRE PERSONNEL :
AUCUN



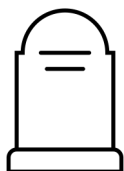
Généralités



- OMS: « Pandémie » février 2020



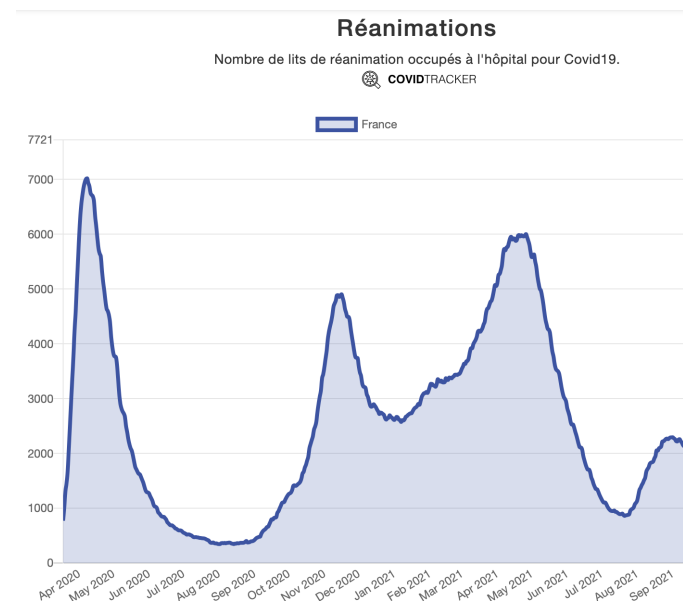
- Contaminations: 230 millions
- Décès : 4,7 millions



- Mortalité en réanimation: 30%



- 1^{ière} admission au CHU d'Amiens en réanimation: le 28 février 2020



EDITORIAL

Open Access

COVID-19 pneumonia: ARDS or not?

Luciano Gattinoni^{1*}, Davide Chiumello² and Sandra Rossi³



16/4/2020

Description de deux types de SDRA dus au Covid-19 :

- **Type 1:** severe hypoxemia is associated with respiratory system compliance > 50 ml/cmH₂O. The lung's gas volume is high, the recruitability is minimal, and the hypoxemia is likely due to the loss of hypoxic pulmonary vasoconstriction and impaired regulation of pulmonary blood flow.
- **Type 2:** In 20–30% of COVID-19 patients, severe hypoxemia is associated with compliance values < 40 ml/cmH₂O, indicating severe ARDS.



- ❖ Pr Daniel Rodenstein (Pneumologie Saint Luc, Bruxelles)
- ❖ Pr Vincent Jounieaux (Pneumologie, CHU Amiens)
- ❖ Pr Yazine Mahjoub (Réanimation CTVR, CHU Amiens)

LETTER

Open Access

Severe Covid-19 disease: rather AVDS than ARDS?



Yazine Mahjoub^{1*}, Daniel Oscar Rodenstein² and Vincent Jounieaux³

25/4/2020

1) *Hospitalisation* : « happy hypoxia »

2) *Réanimation* : « ARDS type 1 » avec compliance
→ Pr Yazine MAHJOUB – Réanimation CTVR – CHU Amiens

3) *Post réanimation* : normalisation de la gazométrie malgré la persistance ou l'aggravation des opacités alvéolaires

→ ***Shunt intrapulmonaire.***



A pulse oximeter on a
COVID-19 patient's
finger measures
blood oxygenation.

COVID-19

The mystery of the pandemic's 'happy hypoxia'

Doctors debate how to treat patients with low blood oxygen but without trouble breathing

Jennifer Couzin-Frankel

Science 01 May 2020: Vol. 368, Issue 6490, pp. 455-456

DOI: 10.1126/science.368.6490.455:

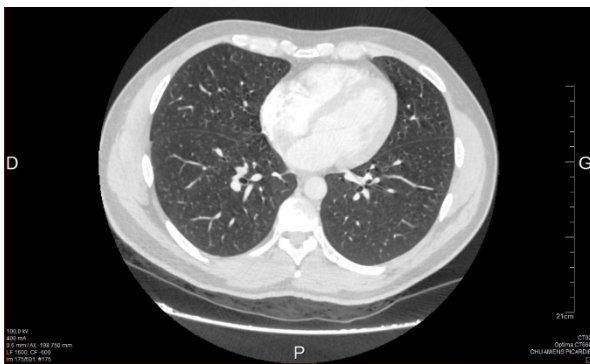
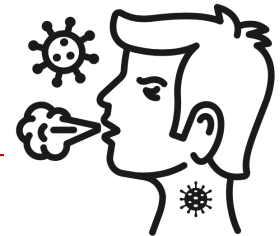
CASE REPORT

Open Access

Pure SARS-CoV-2 related AVDS (Acute Vascular Distress Syndrome)



Vincent Jounieaux^{1*}, Damien Basille¹, Osama Abou-Arab², Marie-Pierre Guillaumont³, Claire Andrejak¹, Yazine Mahjoub² and Daniel Oscar Rodenstein⁴



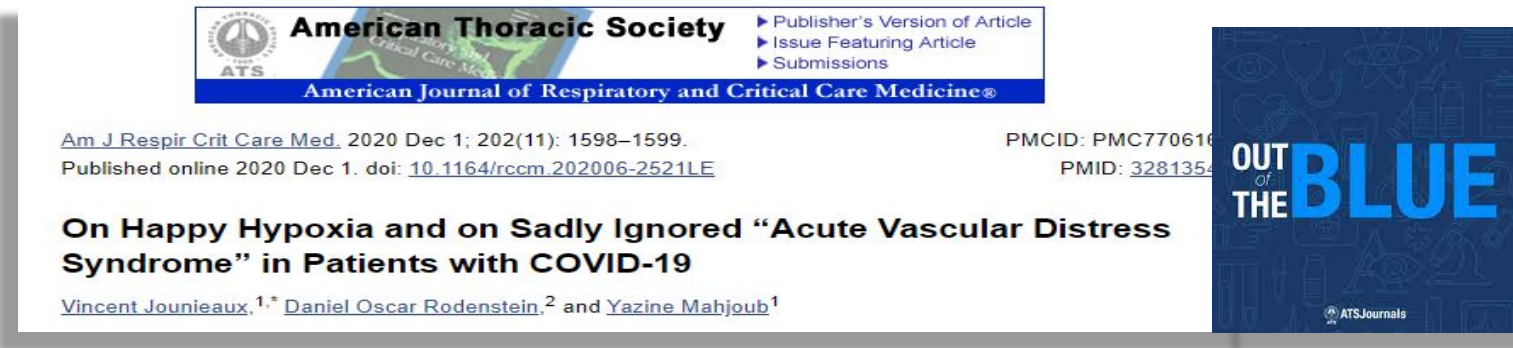
- Collègue du CHU, sportif, sans ATCD
- RT-PCR Sars-Cov2 +
- Dyspnée +++ malgré angioscanner normal !

Shunt intrapulmonaire objectivé par échocardiographie + épreuve de contraste, explique :

- Alcalose respiratoire avec hypocapnie
- Malaise avec paresthésies
- FR 10 cycles/min
- Amélioration de la dyspnée en procubitus

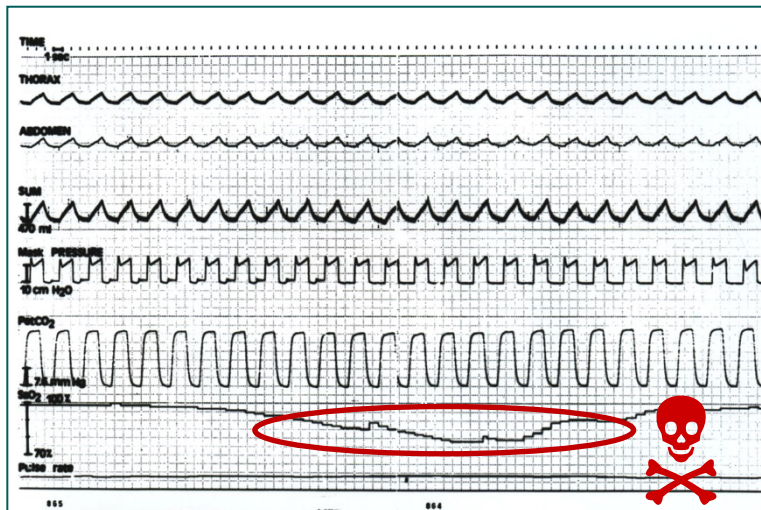


PHASE INITIALE COVID-19



Shunt intrapulmonaire objectivé par échocardiographie + épreuve de contraste explique le phénomène de « Happy hypoxia »

- Shunt intrapulmonaire en l'absence de lésions alvéolaires associées est responsable d'une hypoxie-hypocapnie
- **Or hypocapnie : le plus puissant inhibiteur de la ventilation**

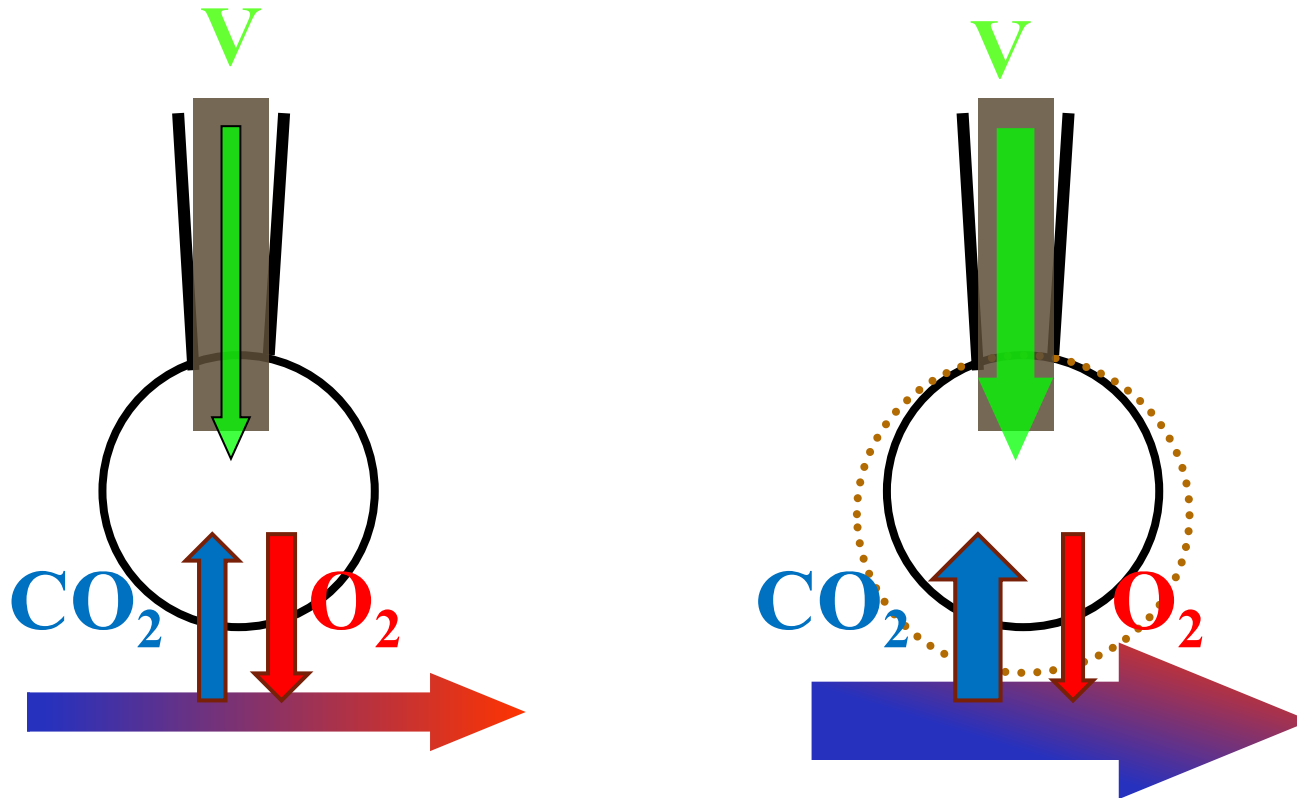


- Inhibition du stimulus hypoxémique par l'hypocapnie...
- Désaturation (SaO_2 de 64%) : aucune réponse ventilatoire, aucun éveil EEG si $\text{PCO}_2 < 30$ mmHg



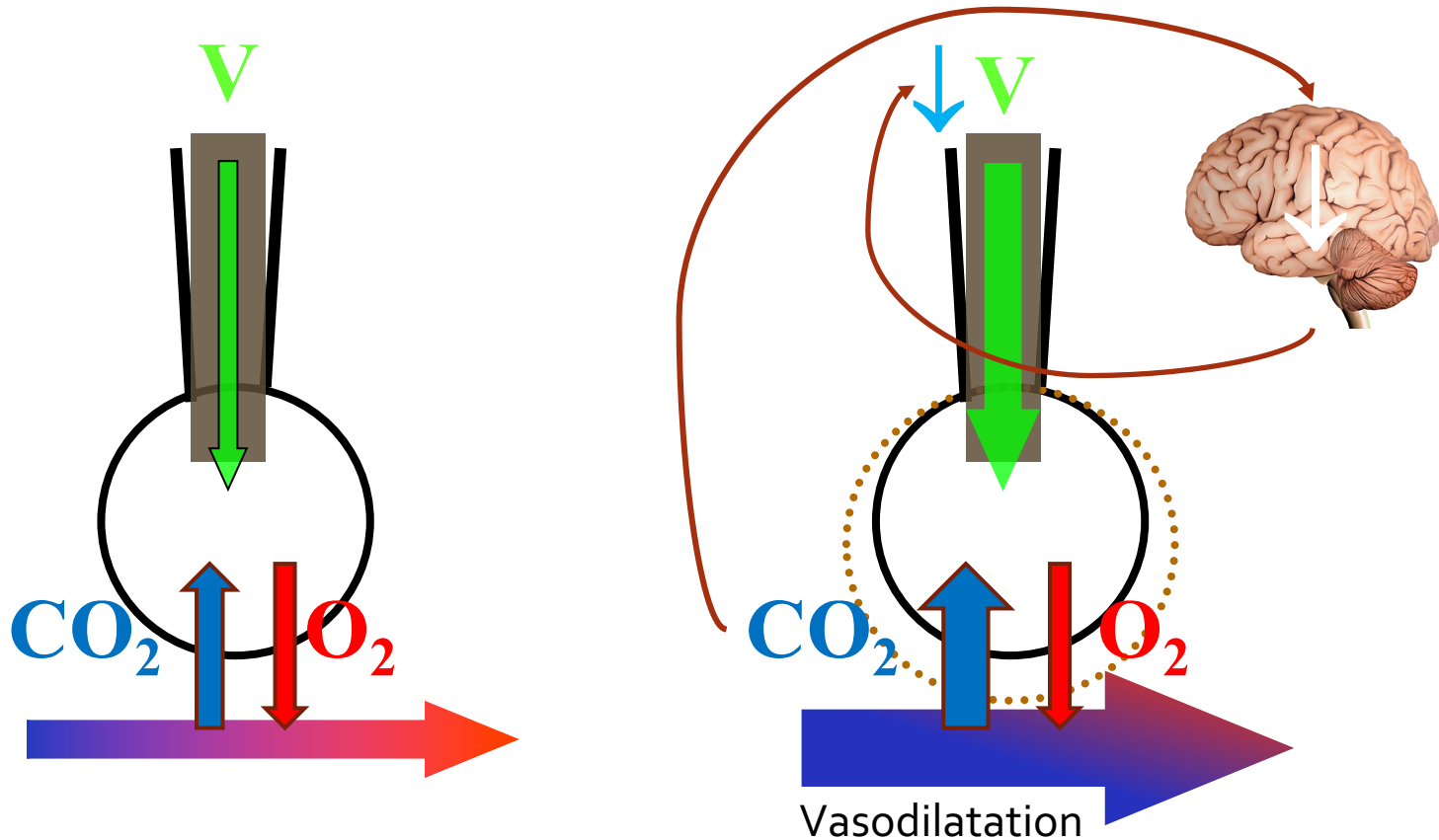
Jounieaux et al. 2002, 121 : 1141-1148.

Hypothèse physiopathologique



Vasodilatation pulmonaire responsable d'un
shunt intrapulmonaire
(syndrome hépato-pulmonaire)
Hypoxémie, hyper débit cardiaque ? ↓RVP ?

« Happy hypoxia »



$\text{SaO}_2 < 90\%$ sans sensation dyspnéique

PHASE POST-RÉANIMATION COVID-19

Dissociation between the clinical course and chest imaging in severe COVID-19 pneumonia: A series of five cases

Damien Basille, MD, PhD^{a,b,*}, Marie-Anne Auquier, MD^c, Claire Andréjak, MD, PhD^{a,b},
Daniel Oscar Rodenstein, MD, PhD^d, Yazine Mahjoub, MD, PhD^e,
Vincent Jounieaux, MD, PhD^{a,b}, on behalf of the A&P Group¹

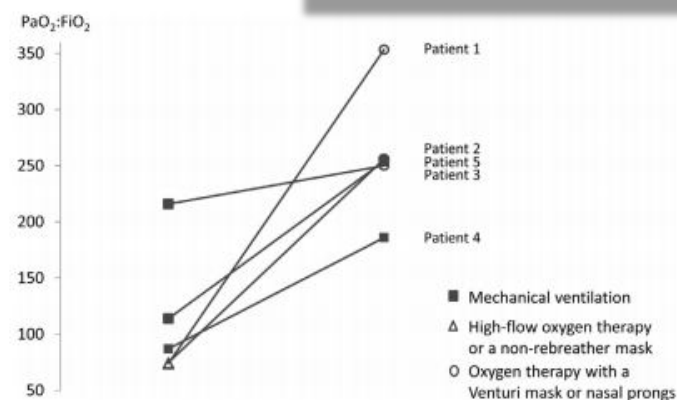
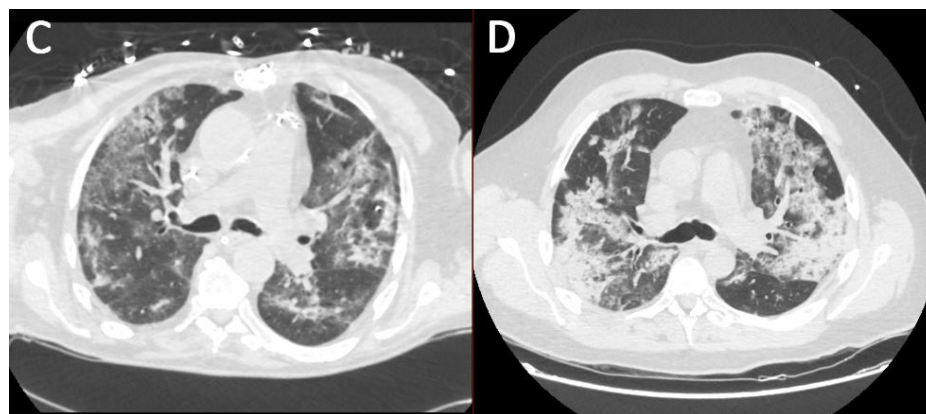
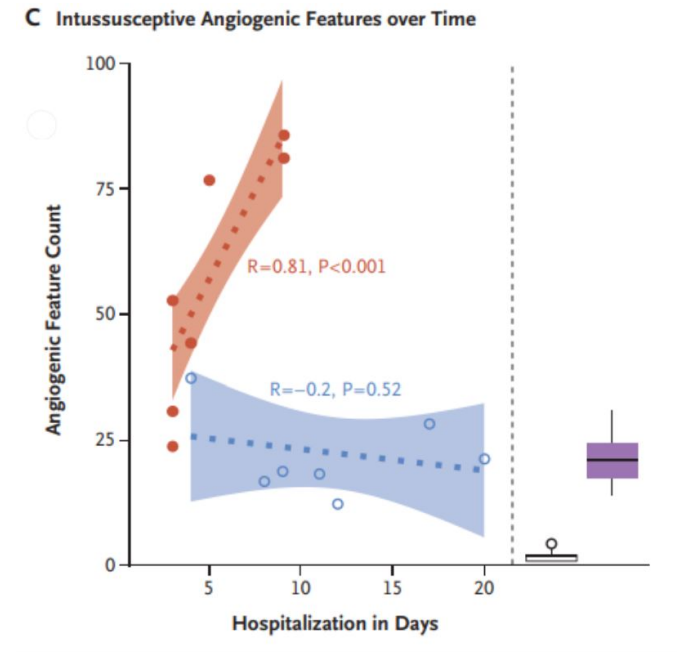
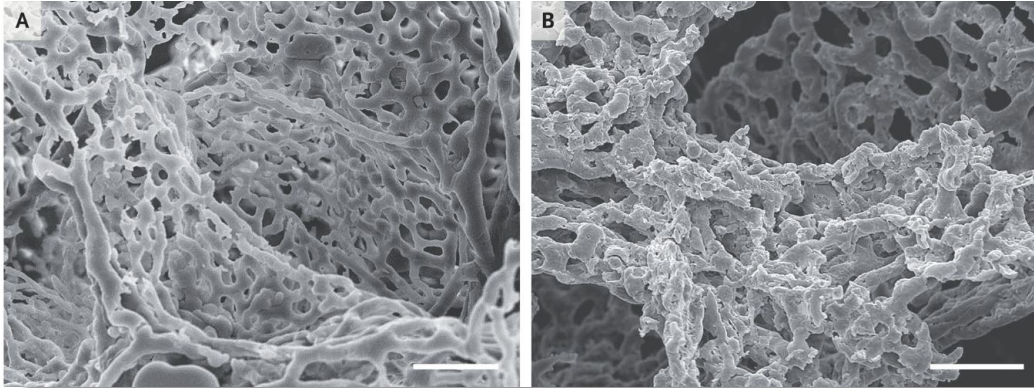


Fig. 4. Changes in the $\text{PaO}_2:\text{FiO}_2$ ratio between ICU admission and the follow-up evaluation.

$\text{PaO}_2:\text{FiO}_2$ ratio data are presented for each patient at baseline (ICU admission) and at the follow-up imaging evaluation.

- 5 patients/ 46 (10,9%) showed an improvement in their clinical status but not in their chest imaging findings.
- $\text{PaO}_2:\text{FiO}_2$ ratio increased significantly in all cases (from 113.2 ± 59.7 mmHg at admission to 259.8 ± 59.7 mmHg at a follow-up evaluation; $p=0.043$).
- $\text{PaO}_2:\text{FiO}_2$ ratio might be a good marker of the resolution of COVID-19-specific pulmonary vascular insult.

Autopsies



• Ackermann M et al.

Pulmonary Vascular Endothelialitis, Thrombosis, and Angiogenesis in Covid-19.

N Engl J Med. 2020. DOI: 10.1056/NEJMoa2015432.

- Ultrastructural damage to the endothelium,
- Presence of Sars-Cov-2 in endothelial cells of
- Pulmonary angiogenesis observed at day 4 hospital admission and significantly increases with time

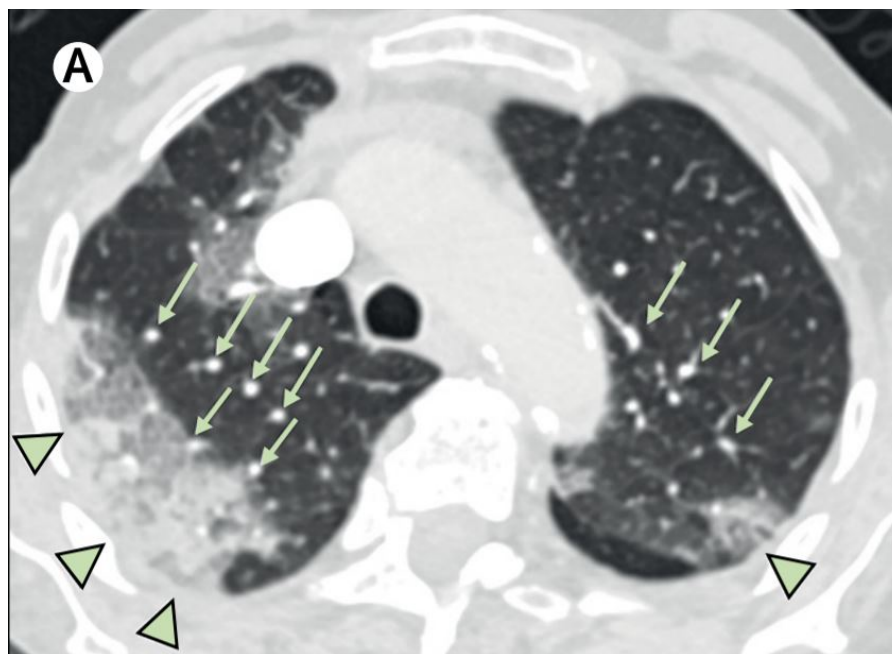
Imagerie thoracique



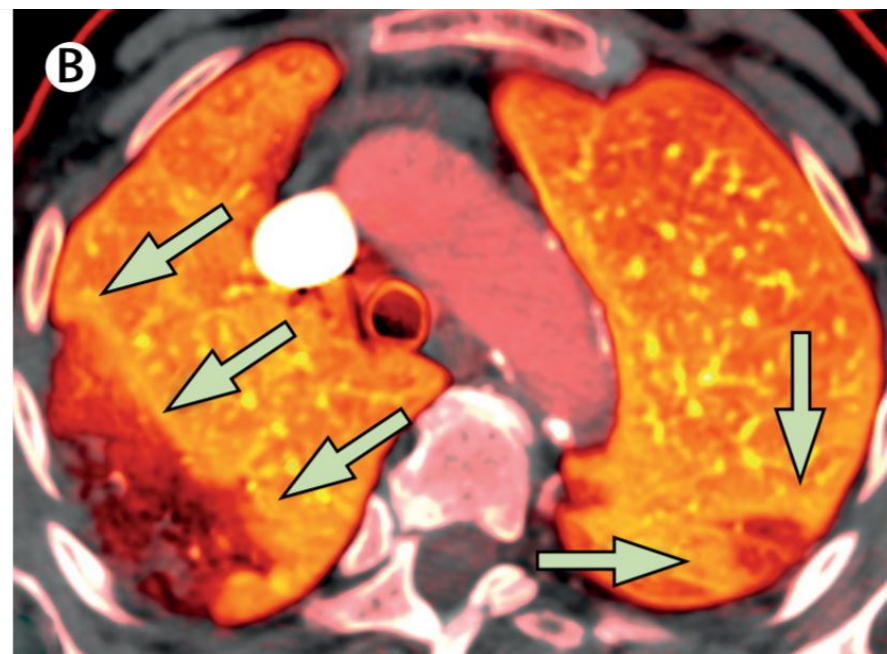
- Lang M et al.

Hypoxaemia related to COVID-19: vascular and perfusion abnormalities on dual-energy CT.

Lancet Infect Dis. 2020 Apr 30. doi: 10.1016/S1473-3099(20)30367-4.

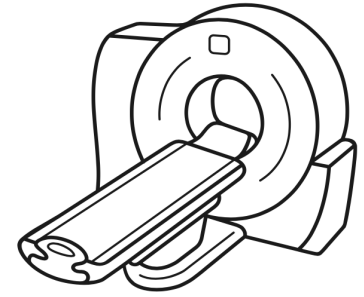


Dilatations vasculaires



Zones d'hypervascularisation

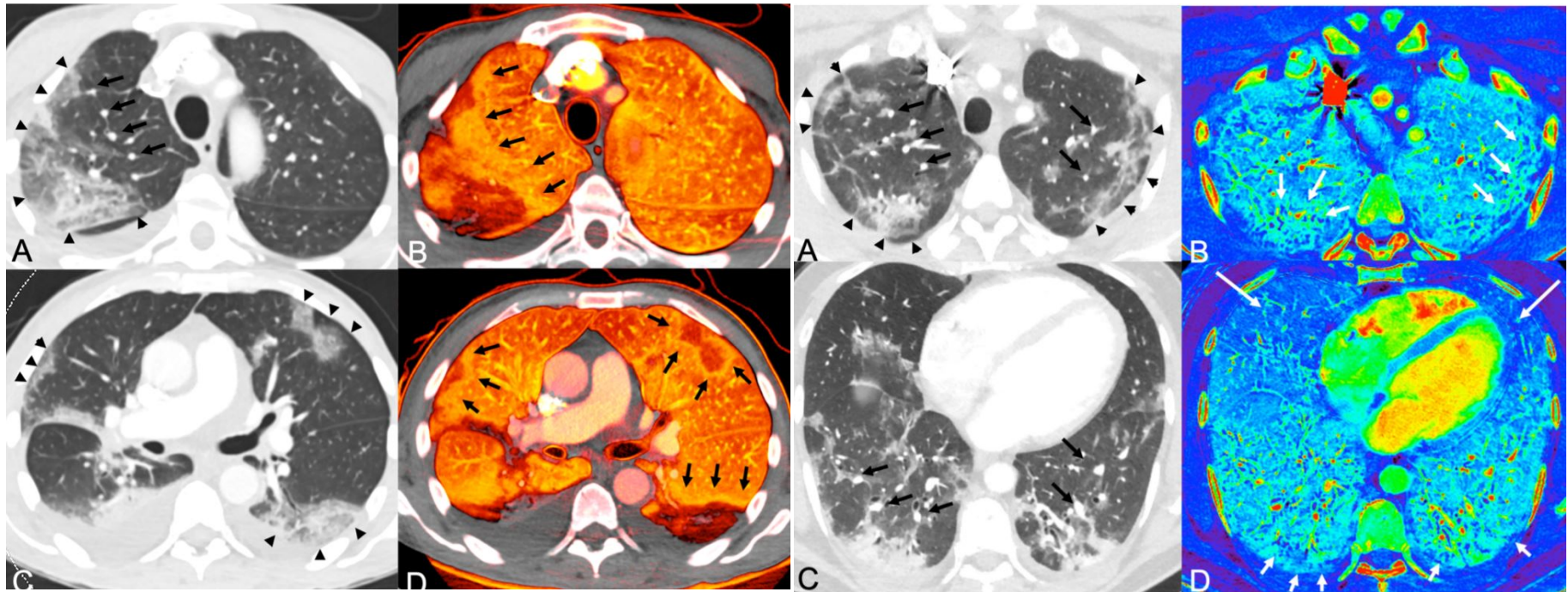
Imagerie thoracique (2)



- Lang M et al.

Pulmonary Vascular Manifestations of COVID-19 Pneumonia

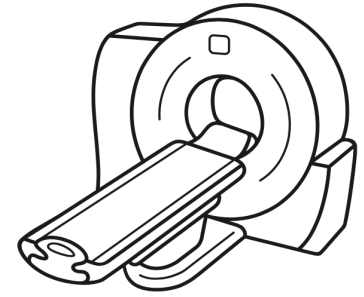
Radiology: Cardiothoracic Imaging, <https://doi.org/10.1148/ryct.2020200277>



Zones d'hypervascularisation

Dilatations vasculaires

Imagerie thoracique (3)



- Lang M et al.

Pulmonary Vascular Manifestations of COVID-19 Pneumonia

Radiology: Cardiothoracic Imaging

<https://doi.org/10.1148/ryct.2020200277>

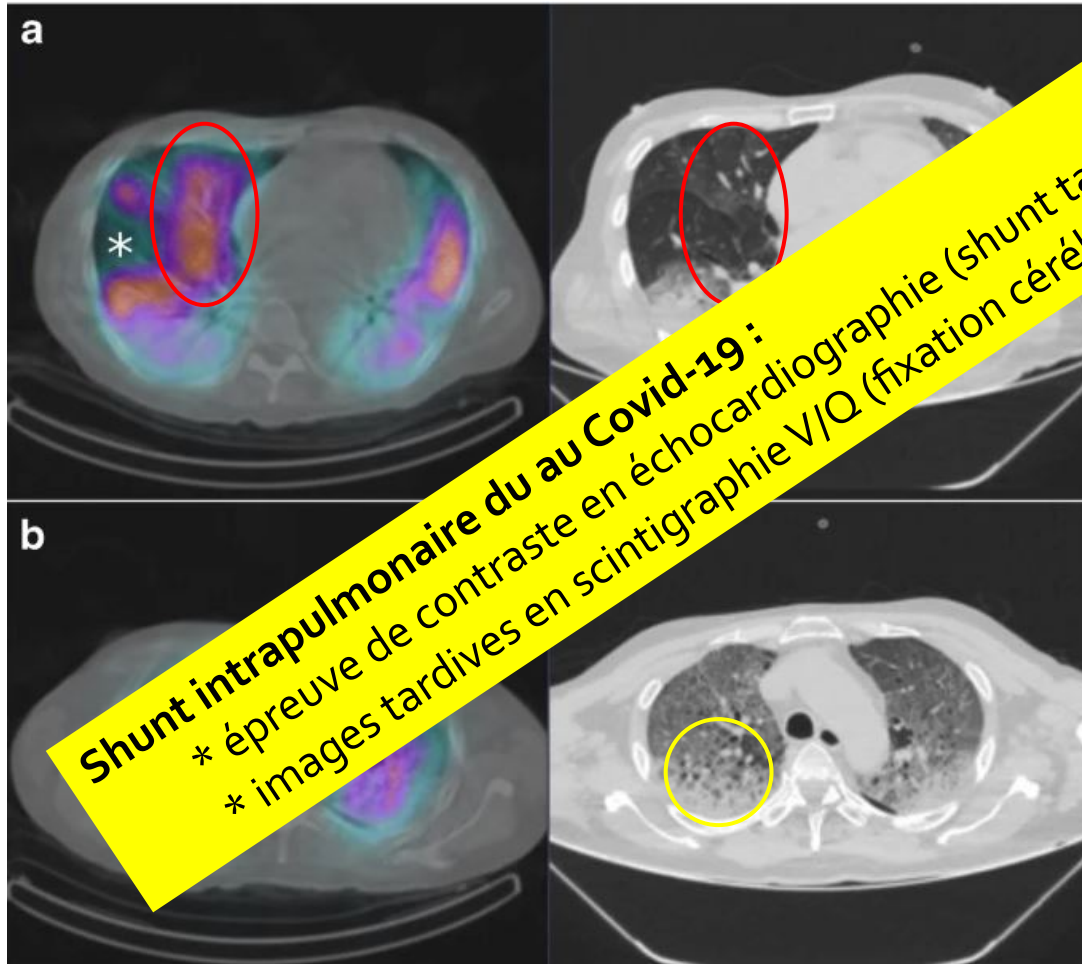
- 45 patients with 18 admitted to the ICU, and 13 requiring intubation :
- 15% : pulmonary emboli.
- **85%** : dilated vessels 78% and 55% of cases demonstrating vessel enlargement within and outside of lung opacities, respectively.
- Dilated distal vessels extending to the pleura and fissures were seen in **82%** and 61%, respectively.
- On DECT, regional hyperemia overlapping with areas of pulmonary opacities or immediately surrounding the opacities were seen in **52%**

The importance of lung hyperperfusion patterns in COVID-19-related AVDS



European Journal of Nuclear
Medicine and Molecular Imaging

Vincent Jounieaux¹ · Yazine Mahjoub² · Isabelle El-Esper³ · Daniel Oscar Rodenstein⁴



Shunt intrapulmonaire du au Covid-19 :
* épreuve de contraste en échocardiographie (shunt tardif, après 10 systoles)
* images tardives en scintigraphie V/Q (fixation cérébrale)

Hypervascularisation dans
des territoires « sains »
(par vasodilatation pulmonaire)

Toute les anomalies V/Q
observées au cours de
l'infection Covid-19 ne sont
pas attribuables à des EP.

Hypervascularisation dans
des territoires condensés
(par perte de la
vasoconstriction
pulmonaire hypoxique)

L. Monaco et al. Eur J Nucl Med Mol Imaging (2021). doi.org/10.1007/s00259-021-05377-1



frontiers

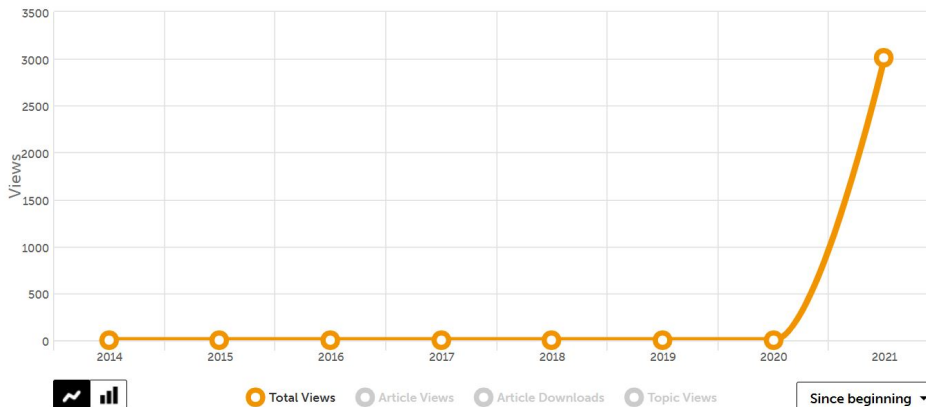


Research Topic

COVID-19 Related Acute Vascular Distress Syndrome: from Physiopathology to Treatment

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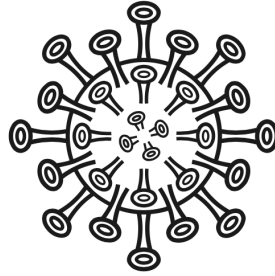


Daniel Rodenstein

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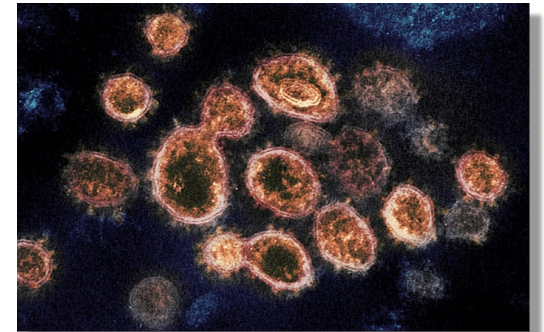
Follow

Conclusions



- « Happy hypoxia » : signe fonctionnel caractéristique de l'infection Covid-19
- > 10% de patients Covid-19 hospitalisés en réanimation dont l'amélioration spectaculaire de leur $\text{PaO}_2/\text{FiO}_2$ malgré l'aggravation de leur atteinte radiologique pulmonaire s'expliquent par l'existence d'un shunt intra-pulmonaire.

- Covid-19 = maladie vasculaire
- Masquée par l'atteinte pulmonaire
- Responsable d'un shunt intrapulmonaire
- Révélé par échocardiographie avec épreuve de contraste ou imagerie spécifique



MERCI POUR VOTRE ATTENTION

