

# COVID - 19 Challenges

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# COVID-19: Overview of Nurse Assessment

Managing COVID-19 patients in south of Switzerland with lung ultrasound for the evaluation of SARS-CoV-2 infection.

Everything started at the beginning of March 2020. In one week, we went from eight to forty-five beds due to COVID-19 patients.

The pandemic virus in place has been scientifically called SARS-CoV-2:

- SARS stands for Severe Acute Respiratory Syndrome
- Co means Corona
- V means virus
- 2 because it is a variant of SARS-CoV (the virus responsible for SARS).

COVID-19 refers to the disease that can develop in patients infected with the SARS-CoV-2 virus, therefore it presents symptoms that can lead to acute interstitial pneumonia with severe respiratory failure, which is why we end up in intensive care. In the case of asymptomatic patients we can say they are SARS-CoV-2 infected, and in the case of sick patients, we can classify them as patients with COVID-19.

## What We Know From First Autopsies in China

The macroscopic features of COVID-19 present in the thorax can include pleurisy, pericarditis, pulmonary consolidation and pulmonary oedema (Shi et al. 2020) (Figure 2). Lung weight may be higher than normal. It should be noted that a secondary infection can be superimposed on the viral infection which can lead to purulent inflammation more typical of bacterial infection generating oedema,

pneumocytic hyperplasia, focal inflammation and formation of giant multinucleated cells probably formed by groupings of histiocytes (Osborn 2020).

Our patients have severe hypoxaemia associated with compliance of the respiratory system higher than normally seen in cases of severe ARDS (Guidance-document-SARS-COVID19):

- Early intubation because they react poorly to non-invasive ventilation and intubation would be delayed.
- From these first experiences, the COVID-19 patient reacts well to 16-18 hour pronation cycles, and in some cases, 24 hours (Sud et al. 2010).
- Better if in controlled ventilation 4-8 ml/kg; at the moment VGRP seems the best solution with plateau under 30 cm/H<sub>2</sub>O.
- FiO<sub>2</sub> high
- Low Driving Pressure ( $\leq 15$ ) compared to high PEEP between 12 and 15 (Liu et al. 2020)
- Closed endotracheal suctioning for safety on contamination (Ling et al. 2020).
- HME seems to be enough but managing secretions is better with an active and heated humidifier (HH) (Cerpa et al. 2015). For invasive setting see schema in **Figure 1**.

In accordance with the AARC Clinical Practice Guideline Humidification During Invasive and Non-invasive Mechanical

Ventilation, I've made a clinical practice bedside assessment. We have the theoretical principles of HH in literature, but not how to set it in practice.

The first publications in this period of the pandemic suggest that patients with confirmed COVID-19 pneumonia demonstrate typical lung imaging (CT) characteristics with frosted glass lesions and consolidations that are located peripherally, bilaterally and primarily at the lung bases.

At this moment lung ultrasound gives similar results to chest CT for evaluation of pneumonia in adult respiratory distress syndrome (ARDS) with the added advantage of ease of use at point of care, repeatability, and low cost (Buonsenso et al. 2020; Blaivas 2012).

In this report, I would like to summarise my experience of how to manage COVID-19 patients in south of Switzerland, with lung ultrasound for the evaluation of SARS-CoV-2 infection. I performed lung ultrasound on 25 ventilated patients using a 12-zone method, 4 windows in supine and 2 windows in prone position on both lung (Doerschug and Schmidt 2013) (**Figure 4**).

In these patients I highlighted:

- B lines spread lower lobes, few in the middle and none in the apical (**Figure 3**).
- A discontinuous, jagged and thickening aspect of the pleural line.
- Focal consolidation and atelectasis found mainly in the posterior lung

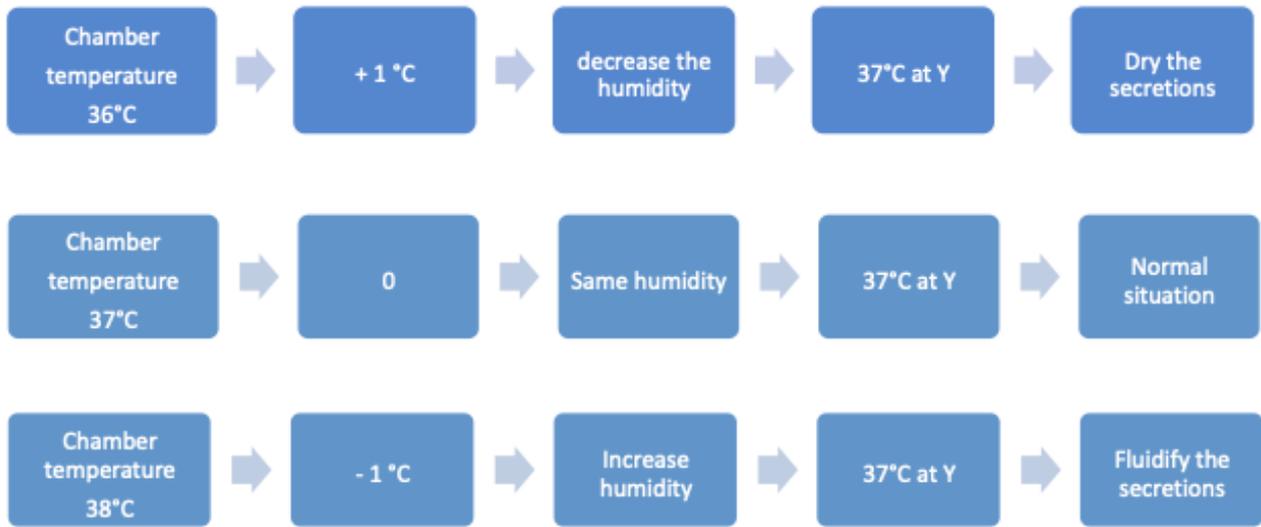


Figure 1. Invasive setting schema. Source Nicole 2020; Restrepo and Walsh 2012.

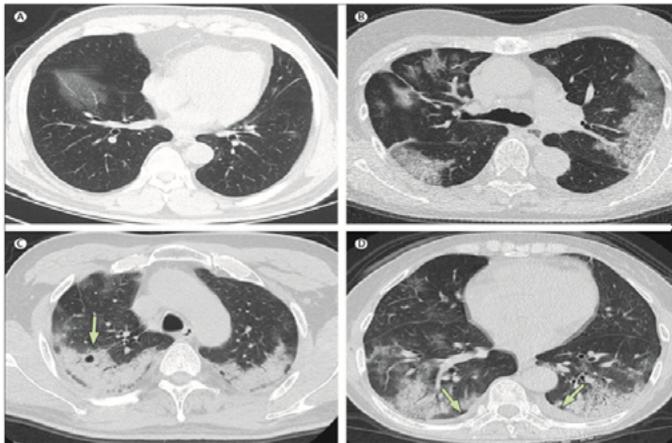


Figure 2: Transverse thin-section CT scans in patients with COVID-19 pneumonia (A) 50-year-old man, day 3 after symptom onset: focal ground-glass opacity associated with smooth interlobular and intralobular septal thickening in the right lower lobes. (B) 74-year-old woman, day 30 after symptom onset: bilateral, peripheral ground-glass opacity associated with smooth interlobular and intralobular septal thickening (crazy-paving pattern). (C) 61-year-old woman, day 20 after symptom onset: bilateral and peripheral predominant consolidation pattern with a round cystic change internally (arrow). (D) 63-year-old woman, day 17 after symptom onset: bilateral, peripheral mixed pattern associated with air bronchograms in both lower and upper lobes, with a small amount of pleural effusion (arrows).

Figure 2. CT scans in patients with COVID-19 pneumonia. Source: Shie et al. 2020.

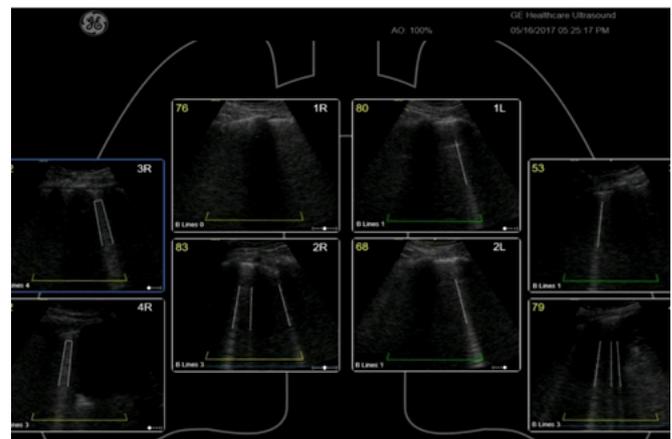


Figure 3. Pattern of distribution on B-Lines. Source: Noon 2020.

fields (paravertebral in prone position examination), in particular in the lower pulmonary fields and here we can deduce how much early pronation can help us. Speaking about PEEP, I would like to present my personal experience. I have come to understand that we have to keep a precarious balance between ventilation with high PEEP for oxygenation and a euvoemia in order not to compromise the heart pump and the kidneys.

To maintain best and protective ventilation, we have to perform PEEP based on

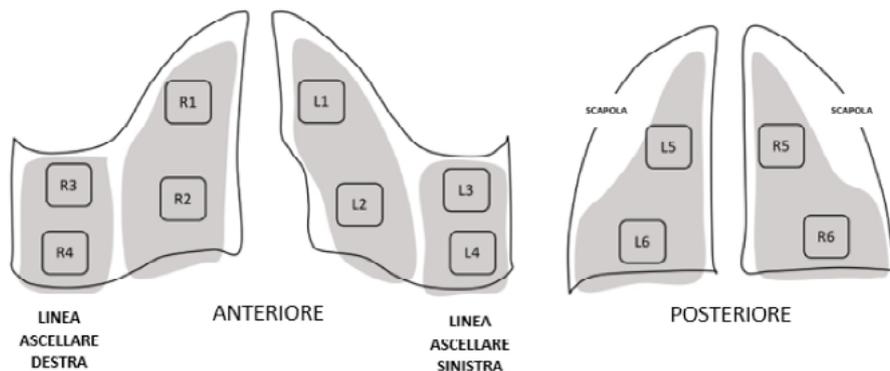
compliance. In these cases we assessed the driving pressure (the difference between plateau pressure and total PEEP keeping it below 16 cm/H<sub>2</sub>O) maintaining a constant tidal volume (6 ml/kg) at different levels of PEEP: the level of PEEP that is associated with the lower driving pressure corresponds to the PEEP which determines the best compliance (obtained by dividing the current volume by the driving pressure) during the delivery of the current volume, is the best PEEP (Pintado et al. 2013).

In the first 7-10 pronation cycles, the

patients responded well to this assessment but gradually these measurers did not give the desired results. On an ultrasound level, I noticed that there was a substantial difference between the two lungs; the less affected one went into overdistention while the other tended to collab. At this point we proceeded positioning patients on the side or in semi-prone. This led to a substantial drop in plateau pressures and driving pressure. This was confirmed with the bedside use of the ultrasound.

Now that the lung has reopened (Figure

## ECOGRAFIA POLMONARE – COVID-19



Effettua la scansione di ogni regione prendendo un'immagine da ogni area che rappresenta al meglio la patologia pertinente. Laddove un paziente non può essere pronato ed è supino, le immagini sulla linea ascellare posteriore possono sostituire le vere immagini posteriori.

DESTRA	DESCRIZIONE	SINISTRA	DESCRIZIONE
R1	Apice superiore destro	L1	Apice superiore sinistro
R2	Lobo medio destro	L2	Lobo medio sinistro
R3	Linea ascellare superiore destra	L3	Linea ascellare superiore sinistra
R4	Linea ascellare inferiore destra	L4	Linea ascellare inferiore sinistra
R5	Posteriore superiore destro	L5	Posteriore superiore sinistro
R6	Posteriore inferiore destro	L6	Posteriore inferiore sinistro

### Legenda

<b>Linee B</b>	B0	<3 per immagine	/ normale
	B+	3-7 per spazio intercostale	/ blando
	B++	>7 per spazio intercostale	/ moderato
	B+++	Linee B confluenti	/ severo
<b>Distribuzione Linee B</b>	Descrivi come focale, multifocale o diffuso all'interno di quella regione		
<b>Consolidamento</b>	C0	Nessuno	
	C+	Linea pleurica irregolare, sottile consolidamento subpleurico	
	C++	Piccole aree di consolidamento (<1 cm di profondità)	
	C+++	Vaste aree di consolidamento	
<b>Versamento</b>	Descrivere includendo la profondità massima dalla parete toracica al polmone o dal diaframma al polmone		

### COMMENTI

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INFERMIERE: \_\_\_\_\_ DATA: \_\_\_\_\_

Figure 4. Lung Ultrasound in COVID-19. Source: Ripper 2020. Revised and translated by Nicole C.

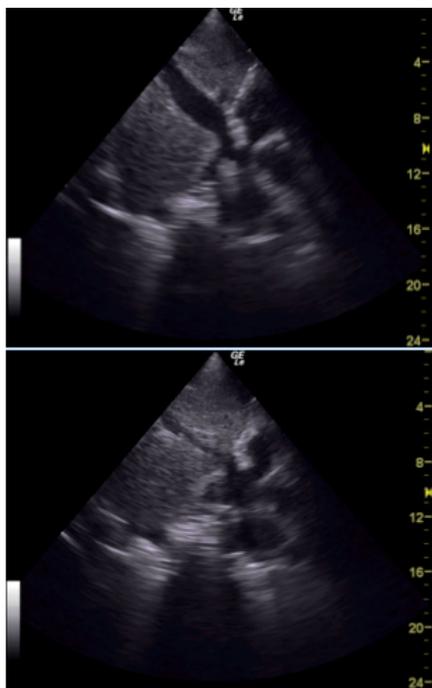


Figure 6. B-Mode: Subcostal Window/Inferior Vena Cava (IVC) before fluid filling

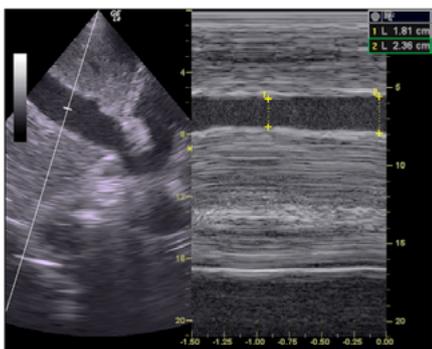


Figure 7. M-Mode: Subcostal Window/Inferior Vena Cava (IVC) after fluid filling

5a and 5b), I would like to go for a heart echography to evaluate contractility and filling. What can I expect to find in a 4-day hospitalised patient with high oxygen support admitted to the ICU? The patient doesn't have to eat and drink much, increased respiratory rate leads to a greater dispersion of water and if we add fever, the cardiac picture is still detected (Figure 6).

After a mild volume filling of 500 ml the picture has substantially changed (Figure 7).

When the patient is in prone position, can I still do the heart echography to assess contractility? The answer is

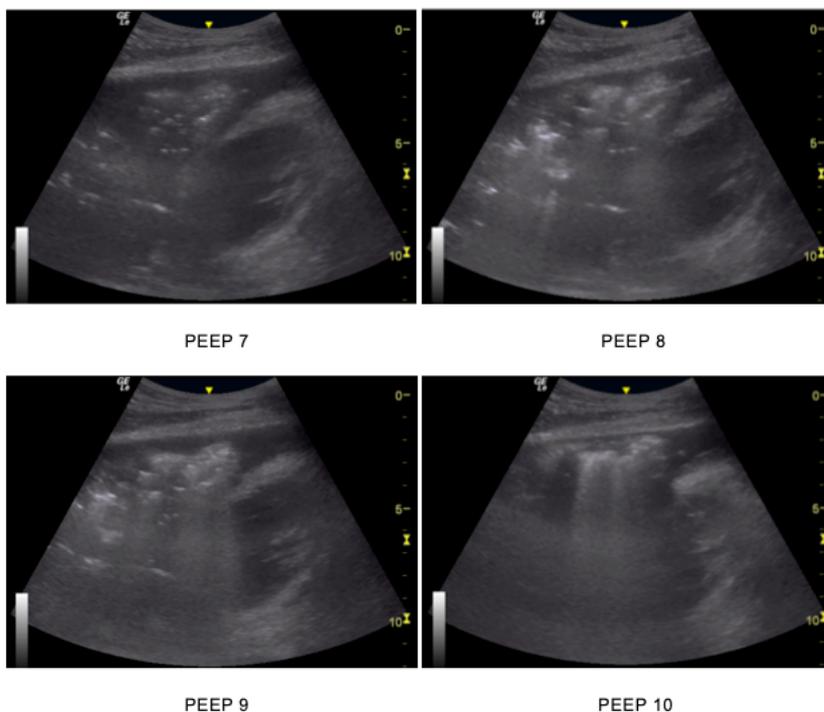


Figure 5a. Ultrasound PEEP assessment

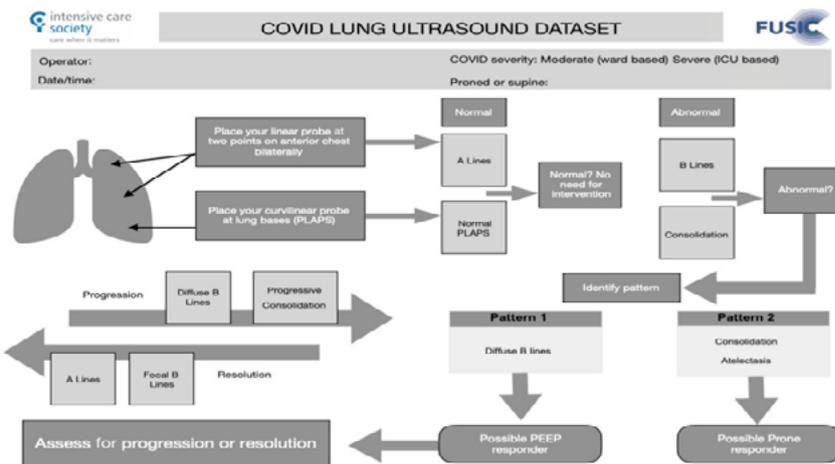


Figure 5b. COVID LUS dataset

yes! How? The patient must be in the swimmer's position with the left arm upwards. Operator positioned on the left of the patient, raise his left shoulder with a pillow forming a space to position the transducer. The ultrasound in a prone position offers all the apical views (2 and 4 rooms) and the relative measures, but no other acoustic window (Ugalde et al. 2018).

An American colleague sent me a

practical sheet to be used for the daily assessment which at the moment seems highly recommendable.

### Conclusion

Most Clinical Nurses Specialist work directly with patients and develop effective health care techniques based on clinical evidence, solving complex problems, and educating nurses. Our professional figures work closely with doctor and nursing administrators,

and especially head nurses to improve the quality of care. Head nurses set goals, monitor important outcomes, and evaluate initiatives. This approach can improve new strategy and take nursing skills to a higher level. In this situation, nurses were able to put together different concepts, bringing an increased of quality care. For years, I have supported ultrasound as a complementary approach to constant patient evaluation and during this healthcare crisis more than ever it has helped to treat our ICU patients in the best possible way. ■

### Ethics Approval

Images are entirely unidentifiable and there are no details on individuals reported within the manuscript. Consent for publication of images is not required and is Swissethics approved.

### Conflict of Interest

The author declares no competing interests.

### Funding/ AuthorshipCredit

The author is an active member of Winfocus, teacher of nursing ultrasound. No fee received for work.

### Acknowledgements

The author is grateful to Michael Blaivas, MD for the availability and support. Thanks to the work and for strategy developing to all Winfocus members. I'm grateful to be a member of The Society of Critical Care Medicine (SCCM) and for their resources. I would like also to thank Barca Romina for language services.

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