COVID-19: THE ROLE OF CPAP
COVID-19 ... A HORRIBLE DISEASE, THE LIKES OF WHICH WE HAVE NOT SEEN BEFORE

- ~15% of hospitalized patients required admission to critical care units as facemask oxygen alone was insufficient to adequately raise blood PaO₂ levels.
- Sudden rush of critically ill patients overwhelmed critical care and ventilator resources in China (in January) and Italy (in February).

SO WHAT DID THEY DO?
... THEY TURNED TO CPAP AND HIGH-FLOW NASAL OXYGEN
PROS AND CONS OF CPAP

**PROS**
- Well-established technique for improving oxygenation in patients with respiratory failure
- Protects scarce ventilator and critical care bed resource
- Much easier to manage with limited and inexperienced staff resource
- Protects patient from harm of ventilator-induced lung injury (“VILI”) and other complications

**CONS**
- Fears about increased risk of viral transmission to healthcare workers
- Delay in intubation + ventilation
- Theoretical risk of ‘spontaneous breathing-induced lung injury’ – “SILI” – from large tidal volumes + high transpulmonary pressures
"The only thing we have to fear is fear itself."

- Franklin D. Roosevelt
COVID-19

Information for Health Care Professionals

When considering a procedure for a patient with known or suspected COVID-19 infection:

- In patient with acute respiratory failure, it may be prudent to proceed directly to endotracheal intubation, because non-invasive ventilation (e.g. CPAP or biPAP) may increase the risk of infectious transmission.
Use of non-invasive ventilation for patients with COVID-19: a cause for concern?

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COVID-19 Infection
Implications for Perioperative and Critical Care Physicians

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Thus, there is a risk that any method of oxygen delivery to a patient with COVID-19–associated respiratory distress can result in spread of virus-containing exhaled air, especially if the mask is poorly fitted or leaking, but the concern that use of noninvasive positive pressure ventilation or high flow nasal cannula specifically leads to worse environmental contamination is not substantiated by the current available evidence.


Lydia Bourouiba, PhD

Figure. Multiphase Turbulent Gas Cloud From a Human Sneeze

JAMA Published online March 26, 2020
From: Du Bin <dubin98@gmail.com>
Date: Thursday, 5 March 2020 at 23:25
To: "Singer, Mervyn" <m.singer@ucl.ac.uk>
Subject: Re: COVID-19 advice please

Dear Mervyn,

It is good to hear from you. As to your questions,

3. NIV and HFNC are everywhere.
I personally agree with WHO interim guidance that HFNC/NIV might have high failure rate, and delayed intubation might eventually lead to death. However, you probably will understand that, when the surge of hundreds of patients with severe hypoxemia were admitted (it is not uncommon for us to see many patients with SpO2 < 80%, even under oxygen therapy), you just do not have enough resources for invasive mechanical ventilation.

Bin Du, MD
Immediate Past President, Chinese Society of Critical Care Medicine (CSCCM)
President, Chinese Association of Critical Care Physicians (CACC)
President, Chinese College of Intensive and Critical Care Medicine
Medical ICU, Peking Union Medical College Hospital
When your child says, 'I've got a sore throat,' you freeze. There's no laughter, no car horns, no cheerful shouting. All you hear are sirens and church bells tolling for the dead...

One Briton's apocalyptic despatch from Italy of what we pray is NOT our destiny

ITALY IN HELL...BRITAIN IN WEEKS?

THE ITALIAN TRAGEDY BY NUMBERS

4,032 total deaths from coronavirus recorded in Italy so far
5,986 New cases in Italy yesterday
9,417 Deaths in Italy yesterday
47% One-day increase in Italy's fatalities
784 The number by which Italy's fatalities exceed China

The Italian tragedy bring with them the worst economic slump. The worst-hit region of Lombardy, the Veneto and Umbria, is the powerhouse of the country. With factories, clothing and engineering expertise all over the world, if the North grinds to a halt, so will the whole country. This was supposed to have been a glorious year for Parma, based on the budget for this year. This was going to be a good year in the next two quarters. That would put the country in the fourth recession in a decade. But no one can reverse the government's policies to cut the NHS. There's an old joke that if you put two Italians in a room, you get three opinions. On this occasion, however, there's almost unanimous agreement that the measures should have been taken earlier during the epidemic.
“I have no data but I’m absolutely sure CPAP is the answer”

Guido Bertolini, Lombardy Regional COVID Emergency Department Response Team

Personal communications
• 30-70% could be kept off ventilators
• No reports of serious HCW infection (wearing PPE)
• No issues with O₂ supply
There is a growing evidence base that there is a significant role for the use of CPAP in COVID-19 positive patients, more so than was initially understood. First reports from China suggested that early intubation and ventilation was preferable to introducing delay by the use of CPAP. However, it is now clearer that CPAP may be of benefit to patients earlier on in the disease process than first thought and may prevent deterioration of some patients to the extent of them not going on to need invasive ventilation.

There will obviously be patients who will require immediate intubation and invasive ventilation at the time of presentation but, in light of this additional information the recent NICE guidelines have been updated to include the use of CPAP in the early stages of the disease.
Learning from experiences in China and Italy, University College London Hospital started preparing - from early-mid March - to use CPAP to save ICU beds and ventilators for those in major need.

Strong buy-in from frontline doctors and nurses and hospital management

- Clinical management algorithm, commencing at the front door (ED)
COVID-19 respiratory pathway (ED)

PROBABLE COVID-19 patient

In extremis?

NO

SpO₂ <94% on RA

YES

Consider discharge

NO

O₂ CHALLENGE:
15 l/min on reservoir bag for 15 mins + Discuss TEP

Sats <94%*

INTUBATION PATHWAY

15 l/min O₂ via reservoir bag + Discuss TEP + Urgent ICU Consultant review + prep for intubation (if appropriate for escalation)

Appropriate for invasive ventilation?

NO

Intubate

YES

Treatment appropriate for ceiling of care

CPAP PATHWAY

Appropriate for CPAP

YES

Treatment appropriate for ceiling of care

NO

CPAP 10cmH₂O, FiO₂ 40-60% + ICU Consultant review

Re-evaluate after 1 hour

SpO₂ > 94%* and comfortable breathing?

NO

Sats < 94%*

Titrating down FiO₂ to max 40%

NO

Sats ≥ 94%*

Transfer to ward
Follow inpatient pathway if deteriorates

YES

CPAP 10cmH₂O, FiO₂ 40-60%

ICU Consultant review

If for intubation
ICU for CPAP
else
AMU for CPAP until Covid status known

OXYGEN PATHWAY

Sats threshold 88% if known previous type 2 respiratory failure

Depth of breathing
Rate of breathing
Breathing comfort should be assessed by:

Subjective effort
Learning from experiences in China and Italy, University College London Hospital started preparing - from early-mid March - to use CPAP to save ICU beds and ventilators for those in major need.

Strong buy-in from frontline doctors and nurses and hospital management

- Clinical management algorithm, commencing at the front door (ED)
- Training of doctors and nurses
- Sought to purchase more CPAP machines (only had 12 in whole hospital)
  .. but none available
- .. So made the UCL Ventura!
Whisperflow wall CPAP (1992)

UCL Ventura CPAP Mark I (2020)

UCL Ventura CPAP Mark II (2020)

.. with improvements to patient circuit, up to 70% reduction in oxygen use
Coronavirus: Mercedes F1 to make breathing aid

By Fergus Walsh
Medical correspondent

29 March 2020 | Health

CPAP devices are less invasive than a ventilator

A breathing aid that can help keep coronavirus patients out of intensive care has been created in under a week.
UK researchers develop breathing machine to help coronavirus patients

Coronavirus: Mercedes helps develop breathing aid

The Telegraph
Mercedes F1 team helps curtail keep coronavirus patients out of intensive care

The Sunday Times
Pub chat revved up Mercedes F1 team to create coronavirus breathing aid

The Guardian
F1 team helps build new UK breathing aid for Covid-19 patients

New York Post
Mercedes Formula 1 engineers help develop coronavirus breathing aid
HAS CPAP MADE A DIFFERENCE?

• No randomised controlled trial data

• UCLH experience:

  • 25% (117/468) hospital COVID-19 admissions received CPAP:
    • .. 45/117 (38%) of whom were not appropriate for invasive ventilation
    • .. 11 (24%) of these 45 ‘ceiling of care’ patients survived

  • Of the 72 CPAP patients for full escalation:
    • 37 (51%) were eventually intubated
    • overall survival 51/72 (71%)
PREDICTORS OF SUCCESS AND FAILURE

- 87 of 117 patients admitted for initial CPAP therapy to intensive care unit
- 16/87 patients had CPAP as 'ceiling of care'
- CPAP 'success' = hospital survival without invasive ventilation (n=30)
- CPAP 'failure' = death for CPAP ceiling of care OR need for invasive ventilation
- Initial resp’y parameters – moderate-to-severe resp’y failure – did not discriminate
- Inflammatory and ventricular dysfunction biomarkers predicted failure