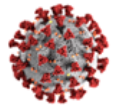
Evidence current as of 24/5/2020



Covid-19

Rapid Review for the EC

Tuesday, 26th May 2020

Review 10

Compiled by Dr Luke Bush, Dr Lauren Lai King and Dr Kamlin Ekambaram

The purpose of this regular review, is to present COVID-19 related questions in Emergency Medicine

We accept that available literature on the topics covered in these reviews may be scarce or incomplete, but shared discussion of novel front line strategies may be a tool to augment our clinical practice and develop future policy

Topic: COVID-19 Respiratory Support - improving mortality outcomes

Please note: This review aims to contextualise the evidence as it relates to the South African context. With the paucity of local outcomes-based evidence this review includes in part, the opinion of the authors.

This review is aimed at encouraging discussion regarding context specific practice.

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Improving outcome and providing care

Covid-19
Rapid Review for the EC

[Allocation of Scarce Critical Care Resources During the COVID-19 Public Health Emergency in South Africa]

[CCSSA - Summary COVID-19 Triage Algorithm]

[WCGH Circular H84 of 2020 - COVID-19 Guidance for professional health workers (nurses and doctors) in Primary Healthcare Facilities]

[WCGH Circular H81 of 2020 - Guidance for Emergency Centres in the Western Cape during the COVID-19 Response]

The NEW ENGLAND JOURNAL of MEDICINE

Fair Allocation of Scarce Medical Resources in the Time of Covid-19

Despite ongoing research into therapeutics that have a direct effect on the virus and our immune response, supportive care is currently the only available management for COVID-19.(1,2)

Interventions that are likely to improve outcomes are:

- **Supplemental oxygen therapies**,
- Thromboprophylaxis and anticoagulation,
- Proning
- Mechanical ventilation (although the mortality outcomes are disappointing*)

Until such time as a vaccine is available, we await further evidence on pharmacological interventions that either modify disease severity, or reduce complications(3).

In our setting, until there is evidence for additional therapies that work, we should be focusing our efforts on optimising what we have available, using the experience from elsewhere as to what therapies improve mortality outcomes and expanding our capacity in line with this.

Guidelines have been provided by the WC DOH for both Primary Care and Emergency Centres. The Critical Care Society of South Africa have developed guidelines regarding triage and allocation of scarce critical care resources. The best utilisation of these critical care resources specific to the South African context is undecided.

The global scientific community is still actively learning about COVID-19 and so guidance will evolve as more is understood and other therapies become available. Context specific guidance is important and should be based on the local evidence available .

*Conflicting data from the USA showing mortality rates between 30-88% for those who were mechanically ventilated. Whilst there is no comparable published South African data, the survival rates are not reassuring.

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References, resources & comments via QR code

Guidelines and Guidance

Guidelines and expert guidance

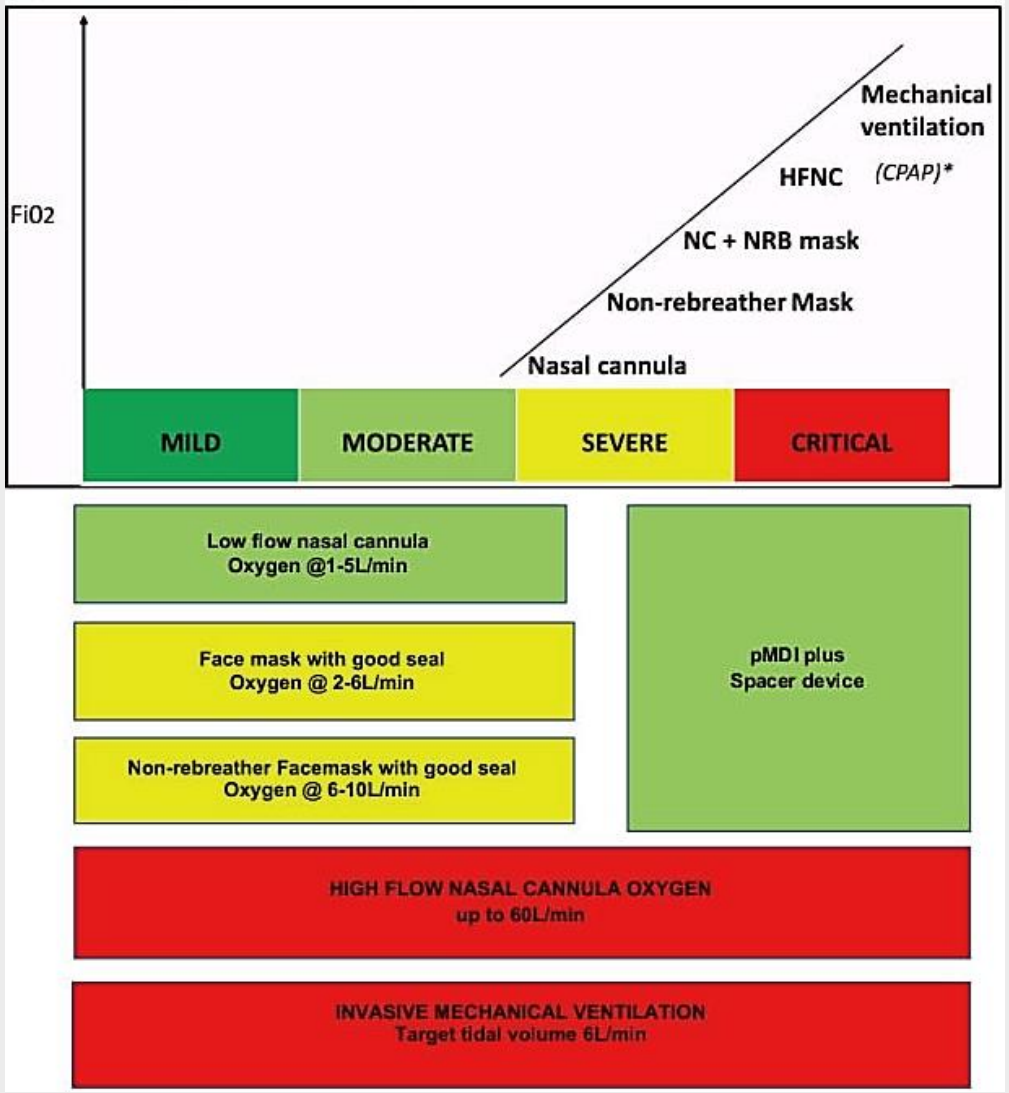
The pathophysiological derangements as a result of COVID-19 disease are not clearly understood. Guidance as to how best to manage patients with COVID-19 type 1 respiratory failure is largely based on expert opinion and from insight gained in managing those with respiratory failure - oftentimes learning from mistakes made. Most countries have included oxygenation strategies similar to that adjacent in the Western Cape Emergency Centre Guideline.

Protocolising clinical interventions based on physiological triggers is difficult due to the heterogeneity of patients and the resource limitations involved with escalating care. The physiological parameters best guiding clinical decision making are SpO2, heart rate (HR), respiratory rate (RR)(4) and an assessment of work of breathing (WOB) - the thresholds for intervention and escalation vary greatly. We still don't know for who, when and how we should be intervening and so a stepwise approach appears appropriate.

Many patients appear to tolerate hypoxia relatively well (silent hypoxia). There are several theories as to the mechanism for the combination of shunt physiology and V/Q mismatch associated with the disease and the diffuse alveolar damage that occurs (5-8). It is possible that increased WOB and worsening hypoxia, may exacerbate the underlying disease process(5).

Because of the poor outcomes associated with severe disease and mechanical ventilation, current protocols focus on early non-invasive interventions to reduce work of breathing and treat hypoxia, which together appear to decrease the need for intubation and mechanical ventilation.

Graduated Oxygen Delivery



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Critical Care Medicine
Society of Critical Care Medicine

Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019 (COVID-19)

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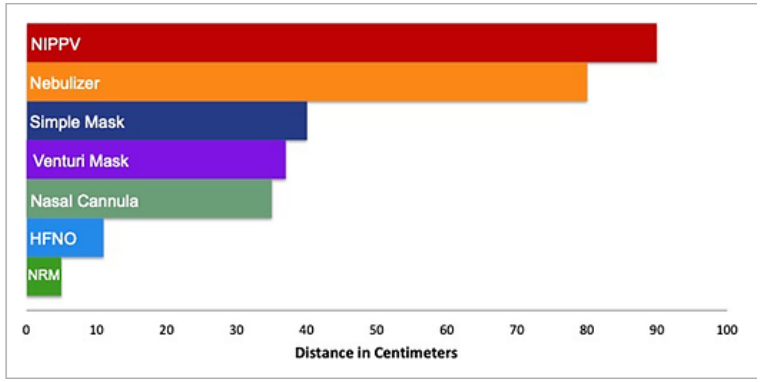
References, resources & comments via QR code

Oxygenation Strategies

All oxygen delivery methods pose a risk for dispersion of aerosol

A surgical mask over the delivery system will reduce dispersal distance

Aerosol dispersal distances without surgical mask



FiO2 achieved at low flow rates ≤10l/min

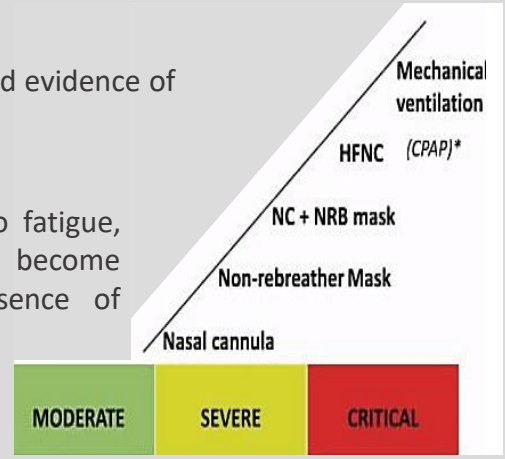
AEROSOLISATION RISK

The dispersion distances between nasal cannula and well-fitting HFNC are similar and less than for a Venturi mask(9). **HFNC disconnection does pose a greater dispersion risk**. The dispersion distance can be reduced by placing a surgical mask over the oxygen delivery system (10).

The evidence suggests that the use of HFNC appears to reduce intubation rates(9) and may improve outcomes and thus, where possible, it should be used with the necessary PPE and protocols in place to protect staff(11).

GRADUAL OXYGEN DELIVERY STRATEGY

The strategy is based on escalating therapy with SpO2 <90%, RR and evidence of increased WOB as triggers to escalate(12).



Is this important?

Despite significant increases in RR many patients do not appear to fatigue, instead as their hypoxia worsens they display signs of hypoxaemia and become confused, bradycardic and eventually cardiac arrest in the absence of intervention(13).

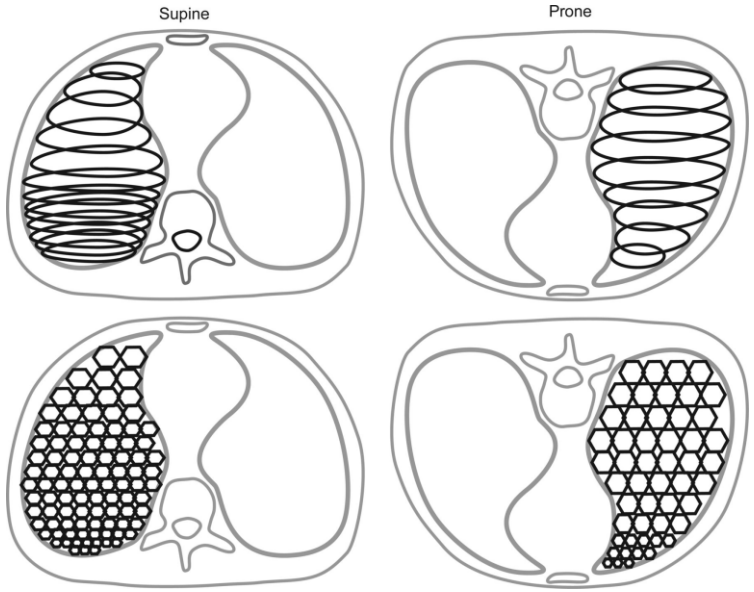
For several reasons some centres initially used an early intubation strategy when patients were failing nasal cannula at 6l/min or had increased work of breathing. Mortality outcomes with this strategy has been poor and so in an attempt to prevent disease progression and the need to intubate, intermediate steps particularly early HFNC is being advised(9).

A significant number of patients present with severe hypoxaemia and in the absence of HFNC, there is a concern that a higher proportion of patients may require mechanical ventilation. It may also be necessary to accept lower SpO2 than we normal would and wait for signs of hypoxaemia or respiratory fatigue as a trigger for intubation where it is available. This may mean that those who are intubated at a later stage, as an intervention of last resort, are less likely to survive than if they had either been on HFNC and then escalated to mechanical ventilation or instead intubated earlier.

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Oxygenation Strategies



Schematic representation of strain-stress distribution and its impact on alveolar size distribution between the supine and prone position

intensive care society — proud to be the voice of critical care since 1970

50 YEARS

Prone Positioning of the Conscious COVID Patient

COVID-19: Oxygen Escalation Therapy and Non-invasive Ventilation

COVID-19 Hypoxemia: A Better and Still Safe Way

ESCALATING CARE TO THE NEXT STEP

This decision requires that there is a next step onto which one can escalate care. For many areas and countries, and even in high income countries, the reality is that this is often not the case.

We are likely to see a ceiling at NC + NRB for many of our patients and the outcomes of those on mechanical ventilation being poor (<10% survival).

HIGH FLOW NASAL CANNULA

Very few facilities have the infrastructure and resources necessary to deliver HFNC support. Where it is possible, reconfiguring ICU and high care services to deliver HFNC should be a priority, initiating patients on HFNC and taking the necessary precautions to protect staff.

HFNC Relieves distress by(14):

- Matching the patient's demand
- Decreases the extent of rebreathing
- Providing a positive pressure in the upper airway
- Reducing inspiratory effort
- Improving oxygenation
- Improving dynamic compliance

AWAKE PRONING

There is good evidence for proning in intubated patients with ARDS(15) and there appears to be success with awake proning patients on both HFNC and CPAP. Patients not on these therapies also see a transient improvement in their SpO2 and RR, but at this point there is no evidence that this improves mortality outcome i.e. patients who may have done well with awake proning may equally have recovered without it. A safe attempt at awake proning is not unreasonable.

CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)

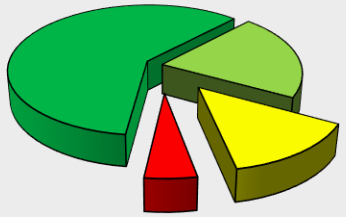
This modality may improve patient outcomes, but it is less well tolerated than HFNC and requires more nursing care. Without closed CPAP systems (helmet CPAP), the risk of aerosolisation poses a significant risk to staff(9). These concerns and recommendations that it be done in a negative pressure environment or in isolations rooms with full aerosol PPE for health care workers, largely preclude it from our setting.

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EC Management

It is important to remember that the majority of people will have asymptomatic or mild disease and may not even present to hospital.



The majority of patients admitted will have moderate to severe disease as defined by NICD criteria.

Age-group (years)	% symptomatic cases requiring hospitalisation	% hospitalised cases requiring critical care	Infection Fatality Ratio
0 to 9	0.1%	5.0%	0.002%
10 to 19	0.3%	5.0%	0.006%
20 to 29	1.2%	5.0%	0.03%
30 to 39	3.2%	5.0%	0.08%
40 to 49	4.9%	6.3%	0.15%
50 to 59	10.2%	12.2%	0.6%
60 to 69	16.6%	27.4%	2.2%
70 to 79	24.3%	43.2%	5.1%
80+	27.3%	70.9%	9.3%

For those with moderate disease (maintaining SpO2 ≥95% on RA), but who are tachypnoeic, a walk test or standing up and down from seated may be done. If their SpO2 declines, or if they have positive radiographic features, they may be at increased risk for disease progression. Depending on bed availability they should be admitted, or if sent home, ideally with SpO2 monitoring available, and told to return if any deterioration. CXR may also suggest another cause, although co-infection is still possible.

Treating hypoxia early and initiating other therapies particularly thromboprophylaxis may improve outcome by reducing the ongoing sequelae of the disease. (16)

	MILD	MODERATE	SEVERE	CRITICAL
WHO description	Uncomplicated upper respiratory tract infection. No pneumonia	Pneumonia with no need for supplemental oxygen	Severe pneumonia	Acute respiratory distress syndrome; Sepsis or septic shock
NICD criteria	RR < 25 bpm Normal mental status Normal mobility status SpO2 ≥ 95 % while breathing ambient air *(optional)* Temperature 36-39°C *(optional)* Pulse rate < 120 bpm *(optional)*	RR < 25 bpm Normal mental status SpO2 ≥ 95 % while breathing room air Temperature 36-39°C Pulse rate < 120 bpm	RR>30 bpm Severe respiratory distress SpO2< 90% on room air or < 93% on 40% facemask Temperature >38°C Pulse rate >120 bpm	Acute respiratory failure and/or shock With Life threatening organ dysfunction including altered mental status, hypoxia, poor perfusion Or lab evidence of coagulopathy, thrombocytopaenia, acidosis, high lactate or hyperbilirubinaemia

WCGH Circular H81 of 2020 - Guidance for Emergency Centres in the Western Cape during the COVID-19 Response – Clinical Categories associated with Adults with COVID-19

The NEW ENGLAND JOURNAL of MEDICINE
Mild or Moderate Covid-19

American College of Emergency Physicians
ADVANCING EMERGENCY CARE
Respiratory support for adult patients with COVID-19

European Heart Journal Acute Cardiovascular Care
Respiratory management in severe acute respiratory syndrome coronavirus 2 infection

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EC transfer to ICU and high care

Covid-19
Rapid Review for the EC

DISPOSITION

- Early critical care discussion and referral for those who meet the criteria for escalation of care.
- Appropriate supportive and palliative care for all patients, remembering that most will recover with oxygen therapy.
- Initiating end of life care for those who despite therapy deteriorate.

CHALLENGES

EQUITABLE ACCESS TO RESPIRATORY SUPPORT

UTILITY OF INTERVENTIONS PROVIDED

TRANSPORTING PATIENTS WITH RESPIRATORY FAILURE

The majority of our patients access care in their communities at primary and secondary services. Those who require access to high care or ICU are transported by EMS. As patients can deteriorate rapidly, early transfer of those failing escalating therapy is advised(17).

Options for safer transfer of those failing NRB and NC are either for the patient to be transferred intubated, or on HFNC where HFNC or CPAP are available at the referral centre*.(17) Transport teams need to have PPE as for any aerosol generating procedure and airway intervention whilst in transit is not advisable – high risk for patient compromise and crew safety.

*Where HFNC is not available at the referring centre, some patients may be temporised on CPAP until HFNC arrives with the EMS service. This poses a high risk of aersolisation and if attempted should only be done in a suitable environment with adequate PPE.

ICU AND HIGH CARE FACILITIES

ICU care particularly in the state sector is usually reserved for those requiring mechanical ventilation. The ability to expand capacity is limited by the ventilator availability and the human resources required to care for ventilated patients in a way that improves their mortality outcome. **COVID-19 patients on mechanical ventilation require prolonged and intense care and the survival rate in state sector ICU's is not reassuring*.**

Where ICU resources are a limiting factor, expanding HFNC capacity in ICU, high care and extending this capability to secondary hospitals may be necessary. This should be considered in an effort to escalate care to mechanical ventilation, in the subset of patients who are likely to be supported through the illness with the resources available.

*No published South African data available - the survival rates are likely <10% at present.

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