EMET Wheatbelt presents:

"COVID-19"

Content by Dr Anand Senthi

MBBS, MAppFin, GradCertPubHlth, FRACGP, FACEM

@drsenthi

EDguidelines.com

Government of **Western Australia**
WA Country Health Service

Topics

- Triage and streaming/cohorting
- PPE
- Assessment
- Management
- Controversies
- Alteration in our approach for
  - Airway management, intubation, cardiac Arrest

Evidence Disclaimer

- The following information is based on very low level evidence.
- Much is based on anecdotes, case series and opinions from doctors in pandemic epi-centres.
- **The evidence is changing rapidly**
  - Some of what we will teach you today will be proven wrong in a month
  - Most published guidelines are already outdated

Triage

Screening and Cohorting

- Use a very sensitive tool to pick up all suspect COVID patients
- Don't be afraid to send "grey area" patients to your COVID area
  - The risk to the patient is very low.
  - The risk to staff (and patients) of a *single* COVID +ve patient going to your "clean" area is very high

Hierarchy of Isolation Effectiveness

- Negative pressure isolation room
- Single room with door shut
- Single room without door (curtain shut)
- Curtained cubicles with curtains closed
- Waiting room with 1.5m distance of separation

Priority of preference to isolation rooms

- 1. Patients with suspected COVID having AGPs (or likely to)
- 2. Patients with suspected COVID receiving oxygen
- 3. Other patients with confirmed COVID-19
- 4. Other patients with suspected COVID-19

Separation of “dirty” and “clean” areas

- Ideally you have 2 areas and you wear appropriate PPE in the dirty and none in the clean
- If COVID was to become high prevalence endemic (now unlikely) PPE required in the clean area too.

PPE

PPE

- 2 or 3 tiered system
  - 2 tiers in Official Guidelines including WA DOH
  - However some centers are formally or informally effectively using a 3rd tier

Tier 1: Routine Care

- Droplet + Contact Precautions
- = Surgical Mask + Eye Protection* + Gloves + Gown
  - * Eye protection = goggles or face shield

Exceptions

- Exceptions requiring consideration of upgrade to Tier 2
  - Collecting swabs from a person who is critically unwell or has symptoms suggestive of pneumonia
  - Routine care of critically unwell patients

Tier 2: Aerosol Generating Procedures (AGPs)

- Airborne + Contact Precautions
- = N95/P2 Mask + Eye Protection + Gloves + Gown

Aerosol generating events
• Coughing/sneezing • NIV or positive pressure ventilation with inadequate seal* • High flow nasal oxygen (HFNO) • Delivery of nebulised/atomised medications via simple face mask • Cardiopulmonary resuscitation (prior to intubation) • Tracheal suction (without a closed system) • Tracheal extubation
Procedures vulnerable to aerosol generation
• Laryngoscopy • Tracheal intubation • Bronchoscopy/Gastroscopy • Front-of-neck airway (FONA) procedures (including tracheostomy, cricothyroidotomy)

*The reliability of seal is greatest with tracheal tube>supraglottic airway>face mask

Tier 3: Highest risk AGPs

- Being instituted at *some* centers only, not in official guidelines yet
- From an ED perspective generally only considered for intubation
- Tier 2 precautions *plus* maximal body coverage (e.g. neck, face, hair) and further minimisation of airborne risk.

Tier 3 PPE Examples

- Change in Eye Protection:
  - Specific use of face shield instead or in addition to goggles
  - Fully enclosed eye protection instead of open design goggles.
- Shoe coverings or cleanable shoes
- Full body suits
- Hoods/additional hair coverings
- Replacement of N95 masks with N100 respirators.
- Powered Air Purifying Respirators (PAPR)
- Other positive pressure hooded devices without air purifying
- Additional post procedure disinfection procedures for equipment (alcohol or chlorine baths) and staff (e.g. showers, changing scrubs)

PPE Risks

- Not properly chosen/worn PPE
- Not properly used PPE e.g.
  - Touching/adjusting mask
  - Taken off mask and put back on
  - Not removing relevant items between patients
- Not properly doffed PPE

Changing surgical or P2/N95 masks if

- Saturated with the wearer's respirations
- Soiled by body fluids
- Contaminated by patient respiratory secretions
- Worn during an AGP
- The mask has been touched and/or manipulated by the wearer.

Common PPE Questions

- Should we wear PPE for seeing "all" patients (not just suspect COVID)?
- Can we bring our own PPE?

- Can chat at the end of the session with anyone likely to do intubation re PPE.

N95/P2 v Surgical Mask

JAMA | Original Investigation

N95 Respirators vs Medical Masks for Preventing Influenza Among Health Care Personnel

A Randomized Clinical Trial

Lewis J. Radonovich Jr, MD; Michael S. Simberkoff, MD; Mary T. Bessesen, MD; Alexandria C. Brown, PhD; Derek A. T. Cummings, PhD; Charlotte A. Gaydos, MD; Jenna G. Los, MLA; Amanda E. Krosche, BS; Cynthia L. Gibert, MD; Geoffrey J. Gorse, MD; Ann-Christine Nyquist, MD; Nicholas G. Reich, PhD; Maria C. Rodriguez-Barradas, MD; Connie Savor Price, MD; Trish M. Perl, MD; for the ResPECT investigators

Participants

- Health care workers routinely positioned within 6 feet of patients working ≥ 24hrs/week.
- Multi-centre study (7 health centres) at outpatient settings
- *"This trial was conducted in diverse outpatient settings serving adult and pediatric patients with a high prevalence of acute respiratory illness, including primary care facilities, dental clinics, adult and pediatric clinics, dialysis units, urgent care facilities and emergency departments, and emergency transport services."*

Intervention

- Cluster randomized to wear N95 or medical masks (surgical masks)
- Instructed to wear mask whenever positioned within 6 feet of patients with suspected or confirmed respiratory illness
- Applied to 4 consecutive winter seasons (12 weeks each season)

Outcomes

- Self reported symptoms → swabs taken within 24hrs and again if signs/symptoms persisted >7 days
- Also 2 random asymptomatic swabs taken per participant per season
- Primary Outcome
  - Detection of Influenza A or B on swabs
  - 4 fold rise in pre/post season serology titres deemed not attributable to vaccination

Results

- 2862 unique random participants of which 1416 participated for more than 1 season
- Overall 4689 HCP-seasons were analysed
- Incidence of Lab confirmed flu
  - 8.2% N95 group and 7.2% in the medical mask group (p=.18)
- Adherence was the same between groups

Secondary outcomes

Secondary Outcomes										
Acute respiratory illness	235	234	354	446	398	519	569	512	1556	1711
Laboratory-detected respiratory infection[b]	47	71	165	201	217	260	250	213	679	745
Laboratory-confirmed respiratory illness[b]	26	31	91	116	111	150	143	120	371	417
Influenzalike illness	13	10	30	45	22	50	63	61	128	166

Received: 3 February 2020 | Accepted: 12 February 2020

DOI: 10.1111/jebm.12381

WILEY

ARTICLE

Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis

Youlin Long[1] | Tengyue Hu[2] | Liqin Liu[2] | Rui Chen[3] | Qiong Guo[1] | Liu Yang[1] | Yifan Cheng[1] | Jin Huang[4] | Liang Du[1]

Long, 2020 Meta-analysis

- 6 RCT's, 9171 participants
- No benefit of N95 over surgical masks in terms of preventing lab confirmed influenza or lab-confirmed viral infections

Conclusion

- N95 do not appear to offer an advantage over medical masks in the **routine care** of patients with suspected or confirmed respiratory infections in outpatient settings
- Limitations
  - Not inpatient settings
  - Included ED's but limited overall ED evidence
  - Obviously does not examine aerosol generating procedures

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Clinical Characteristics of Coronavirus Disease 2019 in China

W. Guan, Z. Ni, Yu Hu, W. Liang, C. Ou, J. He, L. Liu, H. Shan, C. Lei, D.S.C. Hui, B. Du, L. Li, G. Zeng, K.-Y. Yuen, R. Chen, C. Tang, T. Wang, P. Chen, J. Xiang, S. Li, Jin-lin Wang, Z. Liang, Y. Peng, L. Wei, Y. Liu, Ya-hua Hu, P. Peng, Jian-ming Wang, J. Liu, Z. Chen, G. Li, Z. Zheng, S. Qiu, J. Luo, C. Ye, S. Zhu, and N. Zhong, for the China Medical Treatment Expert Group for Covid-19*

ABSTRACT

Clinical Presentation

- Fever (88%) *but about half of these will be afebrile on presentation*
- Dry cough in 67%
- Fatigue 38%
- Sputum production 33%, Shortness of breath 19% Headache 13%, Myalgia;/arthralgia 15%, chills 11%, n+v 5%, diarrhea 4%
- Rhinnitis/nasal congestion only 5% and more in keeping with the common cold/influenza

Clinical Presentation ….

- Mean incubation 5-6 days (range 1-14 days)
- Slow onset severe disease – 2nd week

- In high prevalence/endemic phase will have to consider COVID-19 in a wide range of presentations as a triggering factor or as an incidental finding.

Bloods

- Leukopaenia 1/3, lymphopaenia about half
- CRP > 10 in 61% on admission. Sicker patients have higher CRPs and seems to track illness severity and prognosis
  - If CRP normal in a patient severe respiratory disorder consider other aetiologies
- Procalcitonin <0.5 in 95% patients → but not available in most places in an expedient manner

Micro

- PCR is high specificity but has a high false negative (?20-40%) rate both early in disease and in certain severe patients who are past the viral replication phase and into the inflammatory phase.
- Rapid point of care tests kits detecting IgM/IgG are now available in Australia (but currently banned in WA)
- They have a high false negative rate early in the disease but one kit claims 97% sensitivity and 99% specificity after day 5 of infection
  - However post marketing data is required to prove this is true.

Imaging

- Portable CXR in some patients, especially those being admitted
- CT has:
  - Higher sensitivity than PCR though low specificity
  - Increased risk of disease transfer during transport
  - Results in CT downtime for cleaning
- Consider only where negative CXR and urgent confirmation of diagnosis is required for some reason that will change management.

Why we must flatten the curve

Italy v China

Table. Case-Fatality Rate by Age Group in Italy and China[a]

	Italy as of March 17, 2020		China as of February 11, 2020	
	No. of deaths (% of total)	Case-fatality rate, %[b]	No. of deaths (% of total)	Case-fatality rate, %[b]
All	1625 (100)	7.2	1023 (100)	2.3
Age groups, y				
0-9	0	0	0	0
10-19	0	0	1 (0.1)	0.2
20-29	0	0	7 (0.7)	0.2
30-39	4 (0.3)	0.3	18 (1.8)	0.2
40-49	10 (0.6)	0.4	38 (3.7)	0.4
50-59	43 (2.7)	1.0	130 (12.7)	1.3
60-69	139 (8.6)	3.5	309 (30.2)	3.6
70-79	578 (35.6)	12.8	312 (30.5)	8.0
≥80	850 (52.3)	20.2	208 (20.3)	14.8

Deaths

- *Almost* nobody dies under 30.yo and very few deaths under 60y.o
- Kids only make up 1% of cases
- 87% of deaths above the age of 70y.o

Management of Hypoxia & Respiratory Failure

Discoveries and controversies from the pandemic epicentres

- Happy hypoxics – be less aggressive with therapy
- Proning/rotating awake patients
- Early intubation v HFNC/CPAP
- L & H Patient Phenotypes

Oxygen therapy

- Target sats recommendations are > 90-92% and no more than 96%
  - Note possible recent exception for the "happy hypoxics"
- 1) Nasal prongs 0.5-4L/min
- 2) → Hudson mask 4-8L/min
- 3) → NRB Mask 10-15L/min

Oxygen therapy

- Some centres skip step 2 (HM) because NRM has been shown to have far lower viral dispersal.
- However:
  - If you place a surgical mask over all masks the difference may not be relevant anymore.
  - Also newer Hudson mask often used in our EDs are very similar to NRM in design

NIV

NIV

- Evidence entirely unclear and lacking
- Previous data showed moderately high failure rates in influenza (57-85%) and very high failure rates in MERS (92%).
- However the failure rate in a small cohort in Wuhan was only 48%.
- Anecdotal case series from the pandemic epicentres have supported this lower failure rate.
- There is concern it may increase pressure injury in the lung and worsen ARDS
- There are risks to staff as an AGP though this can be minimized

NIV Minimising Risk to Staff

- A negative pressure room
- Staff in PPE appropriate for AGPs
- Closed-circuit NIV (e.g using Hamilton T1)
- Viral Filter placed between mask and expiratory limb
  - Includes that mask doesn't have an venting hole to room air
- Minimising mask leave as much as possible.

NIV Potential Benefits

- NIV studies and recommendations have frequently conflated CPAP with BiPAP
- CPAP is lower risk to both staff and to lungs
- CPAP has been recommended by the NHS – it certainly delays intubation (if required to manage resources) and *appears to* avoid intubation.
- NIV responsive non-COVID conditions (e.g. APO) are even better candidates for NIV.

NIV Summary

- The evidence and opinion is unclear
- Consider CPAP in select patients with set up to minimse risk to staff
- Avoid BiPAP – consider generally only in acute on chronic COPD exacerbations
  - Most patients with hypercapnia or fatigue (which is uncommon in COVID 19) should be considered for intubation

HFNC

HFNC

- Concerns like NIV re aersolisation and effectiveness in avoiding intubation – both unknown
- Leung 2019 found no difference in *bacterial* aersolisation comparing HFNC and face mask oxygen

HFNC Efficacy

- Rello 2012, small cohort of 25 patients with severe influenza – 45% avoided intubation
- Anecdotal case series from the pandemic epicentres suggests significant success with HFNC at avoiding intubation

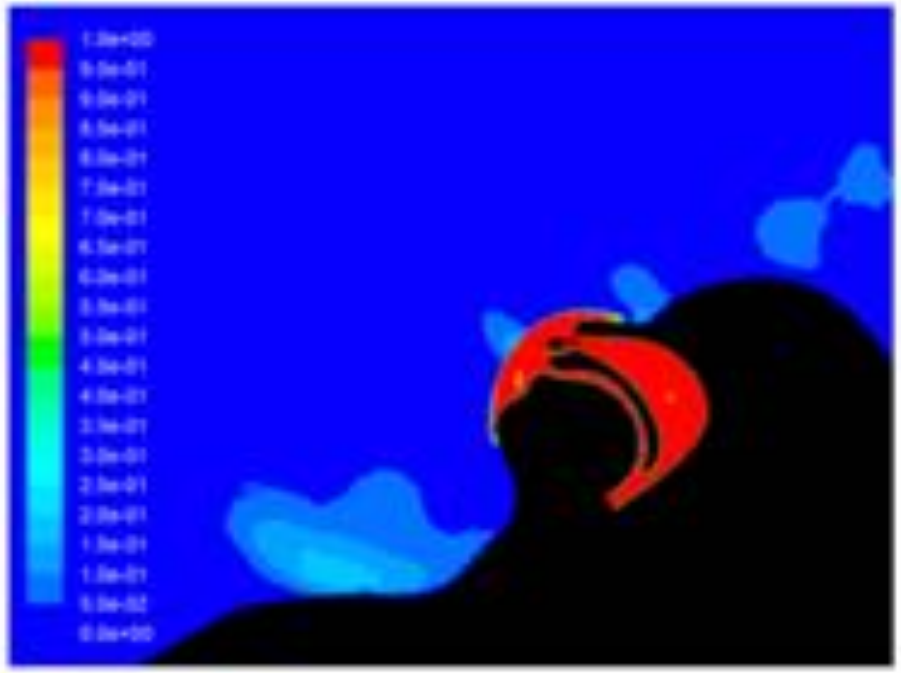


Figure 7. HVNI with Mask – velocity

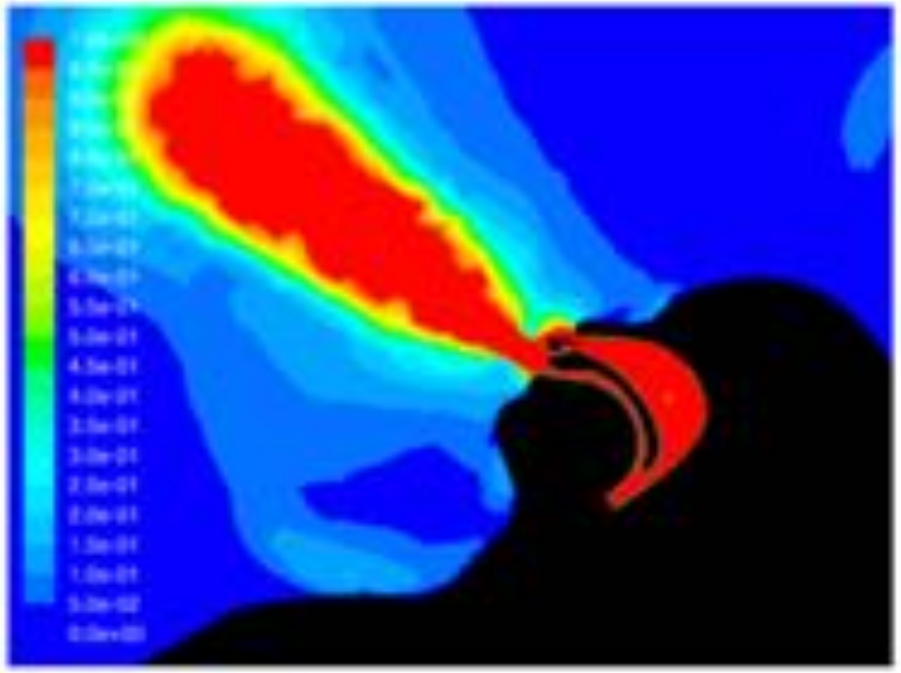


Figure 8. HVNI without Mask – velocity

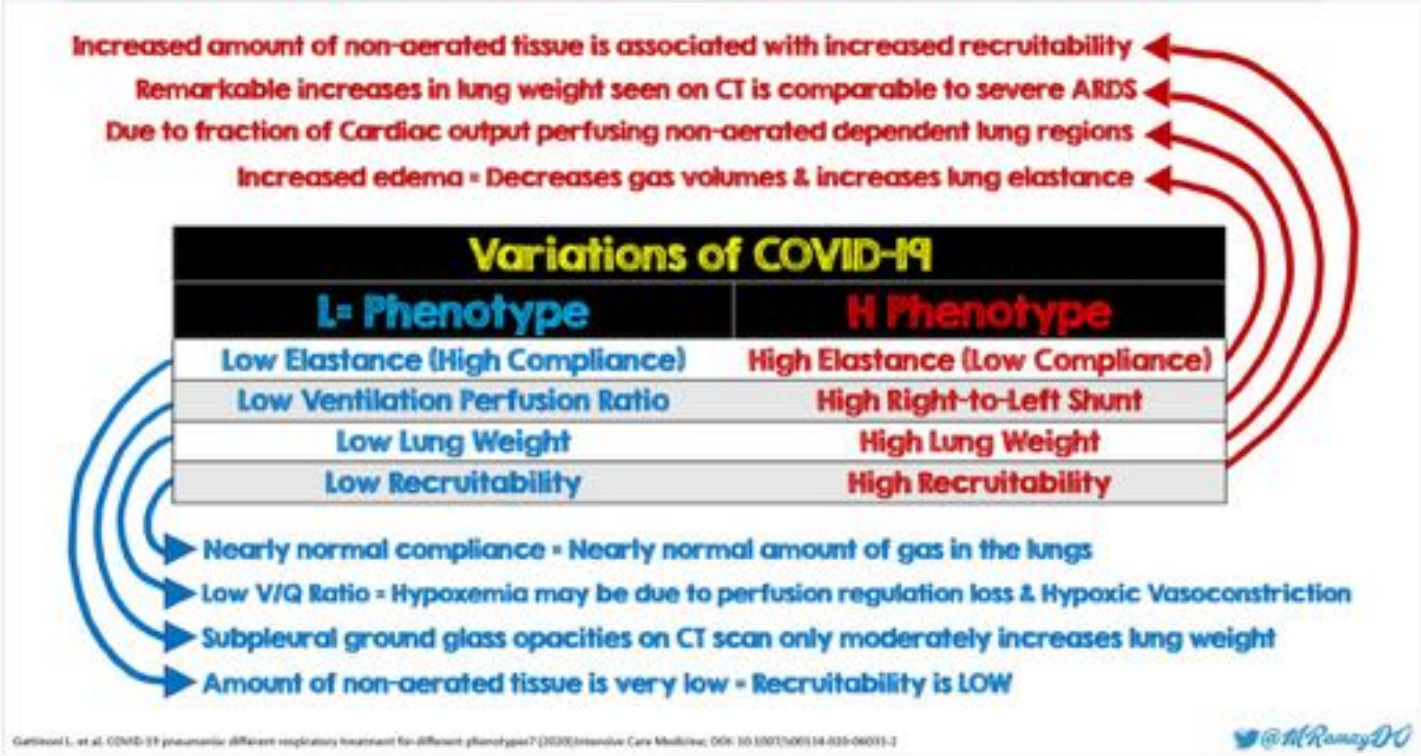
Early Intubation

- No evidence that early intubation is superior in terms of disease spread risk or patient outcomes compared to trial of NIV/HFNC
- Anecdotal case series from pandemic epicentres suggest that
  - Early intubation has prolonged intubation time, high rates of failed extubation and high mortality
  - This may be due to a combination of either:
    - Early intubation causing harm (v's alternative HFNC/CPAP approach)
    - Early intubation being the right approach but the ARDSNet ventilator settings causing harm
    - Nature of the disease in critically unwell – ?high mortality regardless of intervention

Early Intubation…

- Intubation is low risk of viral dispersal when intubated but high risk to staff occurring at
  - Intubation
  - Extubation
  - Unplanned disconnections of circuit → secure connections with tegaderm/tape
- Opinion from pandemic epicentres appears to be swaying away from early intubation

Gattinoni 2020



L (Type 1) & H (Type 2) CT scans

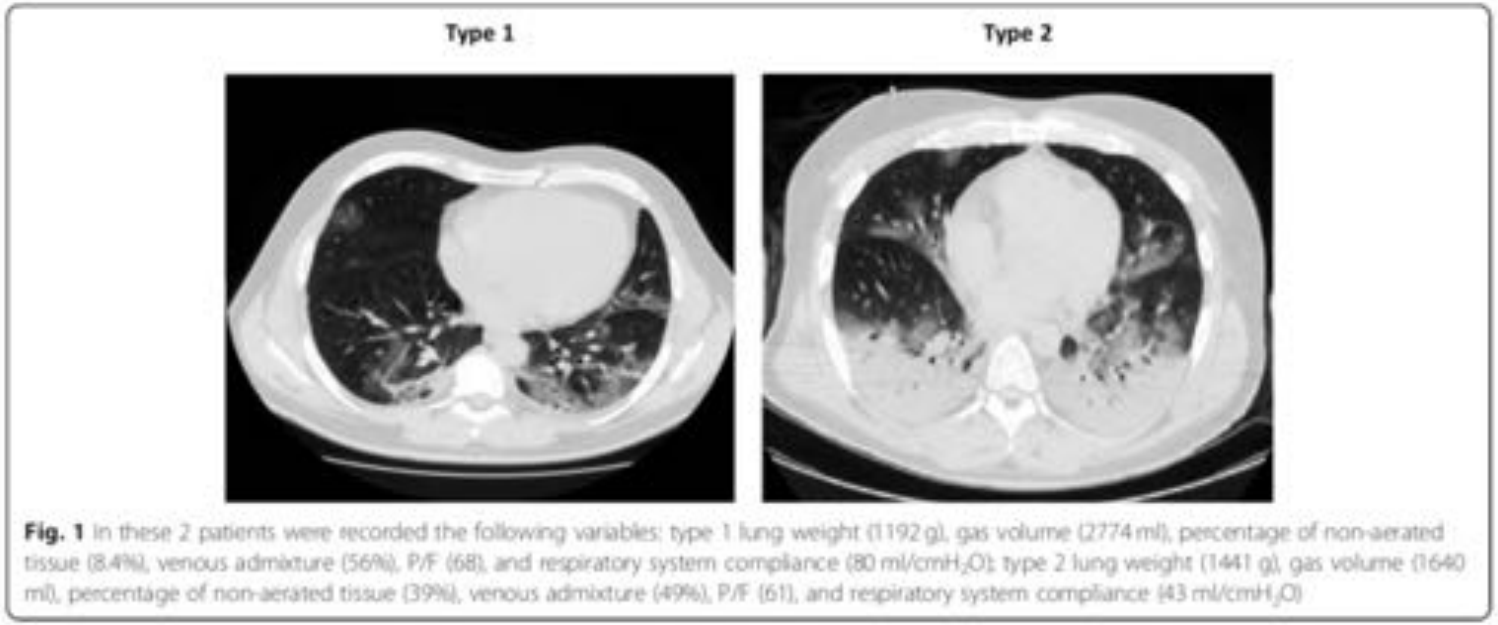


Fig. 1 In these 2 patients were recorded the following variables: type 1 lung weight (1192 g), gas volume (2774 ml), percentage of non-aerated tissue (8.4%), venous admixture (56%), P/F (68), and respiratory system compliance (80 ml/cmH_2O); type 2 lung weight (1441 g), gas volume (1640 ml), percentage of non-aerated tissue (39%), venous admixture (49%), P/F (61), and respiratory system compliance (43 ml/cmH_2O)

Why the hypoxia?

- In Type H, typical ARDS, hypoxia is due to de-recruitment (alveolar collapse) and hence high PEEP recommended
- In Type L there is equally severe hypoxia but mechanism theorized as:
  - V/Q mismatch
    - Ventilating non perfused alveoli: microthrombi in pulmonary arteries
    - Perfusing non-ventilated alveoli: loss of hypoxic vasoconstriction
  - Mild levels of oedema and de-recruitment

P-SILI

- Patient Self Induced Lung Injury (P-SILI)
- Caused by excessive work of breathing
  - → high intrapleural pressure swings
    - → alveolar oedema
      - -→ ARDS
- L types patients appear to be sensitive to P-SILI

Positive pressure induced alveolar injury

- High pressure invasive and non invasive settings
  - → alveolar oedema
    - → ARDS
- Examples:
  - High PEEP CPAP
  - BiPAP
  - ARDSNet (high PEEP) mechanical ventilation

A Middle Ground

- L Type patients are thought to be sensitive to both P-SILI and Positive Pressure Ventilation
- Evolving pandemic epicentre opinion suggests a "modified early intubation approach"
  - → Trial high FiO2/low-intermediate PEEP non-invasive strategies
    - (e.g. HFNC or CPAP with PEEP 5-10cm H20)
  - If this reduces excessive work of breathing → persist
  - If this doesn't → early intubation

High FiO2 may be key

- It is possible that the success of HFNC and CPAP with low-intermediate PEEP may be due to the ability to generate FiO2 close to 100%
- Plus a small amount of alveolar recruitment from the PEEP which ? may actually help redistribute blood flow.

Conflict with guidelines

- Note most Australian guidelines are based on guidelines that are over a month old which is a long time in this pandemic.
- Currently they are still suggesting the "early intubation", no NIV ?HFNC approach.
- Watch this space to see if guidelines evolve in their recommendations
- *Note again that most of this is "educated guesswork" based on low level evidence*

Wheatbelt Considerations

- Lack of availability of HFNC and depletion of oxygen stores at small sites
- Lack of available intubation experience at many sites
- CPAP may be most viable option in many sites
- Retrieval considerations may influence choice of CPAP v intubation
- Early consult with ETS + Intensivist

Intubation

Peri-intubation modifications

- Intubation teams + most capable intubator to intubate
- Video laryngoscopy
- Planning, drugs and equipment preparation *outside the room*

Peri-intubation modifications …

- Taking into the room only what you are likely to need.
  - Leave back up safety equipment with "clean runner" (e.g. hyperangulated D blade, cricothyrotomy equipment)
- Max 3 people in the room only

Drugs

- High dose sux and roc; some recommendations
  - Sux: 1.5mg-2mg/kg
  - Roc 1.5mg/kg

- Ketamine should be part of drugs taken into room as can use for DSI if patient uncooperative with preoxygenation

Preoxygenation + Re-oxygenation

- Use Bag-Valve-Mask (BVM) or Mapleson C circuit
  - 2 handed mask hold
    - 2 thumbs down grip
  - Viral filter between mask and equipment +/- CO2
  - Avoid positive pressure ventilation during apneic period (if can)

Apnoeic Oxygenation

- Avoid due to
  - Risk of aersolisation to staff
  - Unclear if provides benefit in patients with shunt physiology (collapsed alveoli)
    - FELLOW trial 2016

Intubation Process

- Avoid suction as AGP (if can)
- Use indirect view

Post Intubation

- Inflate cuff *before* ventilating
- Minimise and control circuit disconnections
  - Consider immediate connection to ventilator rather than manual ventilations
    - Depends on you set up
  - For planned disconnections clamp ETT first
  - Secure connections liable to accidental disconnection e.g. with Tegaderm

Post Intubation

- Use in-line suction
  - This has implications for your whole set up and planned disconnections

Cardiac Arrest for Suspected COVID-19Patients

To Resus or Not?

- Strongly consider whether to proceed with resuscitation of the arrested patient or not based on likelihood of
  - If out of hospital → consider downtime, quality of CPR provided, rhythm etc
  - If in hospital → consider pre-arrest clinical state, co-morbidities/age, patient/family expressed wishes/advanced care directives

Assessing Response

- Shaking and shouting ok
- When assessing breathing
  - Look for breathing
  - Don't "listen and feel"

Practical Advice – 2 alternatives

1. Attach pads and assessing rhythm first
   - Position defib as far from mouth as possible
   - If shockable – consider 1 shock
     - Then donn Tier 2 PPE for AGPs (whether ROSC obtained or not)

2. Alternatively donn Tier 2 PPE *before* approaching the patient

Other considerations

- Minimise rescuers in the room
- Negative pressure room ideally, single room is not available
- Perform compression only CPR
- Use mechanical CPR if available (e.g. from ambulance)
- If decide to ventilate (? Likely survivable or get ROSC)
  - Pause compressions to reduce aerosol generation during ventilations or tracheal intubation
  - Ideal ventilation route is intubation > LMA > BVM