Community Developed Resource

Evidence-based COVID-19 ICU Management Guide v2.0

Aims of Management Guide

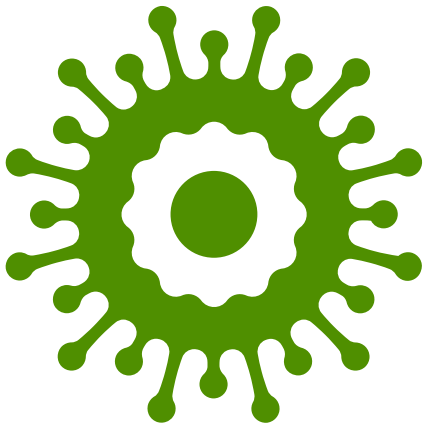
COVID-19 patients admitted to ICU respond to good quality supportive care. This evidence-based guide aims to highlight unique features of COVID-19 management including:

- Monitoring for secondary complications associated with COVID-19 infection
- Differences in approach to common ICU issues to prevent unnecessary interventions which may put patient and staff at risk

Monitoring for Secondary Complications of COVID-19

Four major complications associated with COVID-19 have been highlighted from the literature:

1. **COVID-19 Associated Coagulopathy (CAC)**
2. **Cytokine Storm/Secondary HLH/Macrophage Activation Syndrome**
3. **Secondary Bacterial Superinfection**
4. **Viral Myocarditis** *(may be seen as part of cytokine storm)



Laboratory Investigations on Admission

- CBC, Urea, Creat, Extended Lytes (Mg^{2+}/PO_4/iCa^{2+}), D-Dimer, LFTs (AST, ALT, GGT, ALP, Direct and Total Bili, Alb, LDH), Ferritin, Coagulation Screen (INR/PTT), Fibrinogen, Troponin, Procalcitonin, CRP
- Blood Cultures x 2
- NP Swab for Viral PCR (if not already sent) *for all patients*

AND

- Tracheal aspirates for Viral PCR (if not already sent) *for intubated patients*

Daily Bloodwork

- CBC, Urea, Creat, Extended Lytes, Coagulation Screen, Fibrinogen

Monday/Wednesday/Friday

- LFTs, (AST, ALT, GGT, ALP, Direct and Total Bili, Alb, LDH), Ferritin, D-Dimer, CRP
- Lipid Profile (LDL, HDL, Triglycerides) if ferritin >2000ng/mL in addition to daily orders
- Reassess frequency of these additional tests after Week One

If increasing leukocytosis (WCC >10x10^9/L), clinical concern for bacterial infection AND Temp >38.5°C

- Procalcitonin and pan-culture if not already performed in last 24hrs

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Features of COVID-19 Complications

CAC

Suspect if:
- INR >1.5
- Degree of PTT rise less than INR rise
- Platelets <100x10⁹/L
- Fibrinogen ≤1.0g/L
- D-Dimer positive

ACTION:
✓ Ensure valid Group and Screen available

Cytokine Storm

Suspect if:
- Temperature ≥38.4°C
- Pancytopenia (WCC <4x10⁹/L, Hgb <90g/L, Plts <100x10⁹/L)
- Ferritin >2000mcg/L
- Triglycerides ≥1.5mmol/L
- Fibrinogen ≤2.5g/L

ACTION:
✓ Perform HScore (MedCalc)

Secondary Bacterial Infection

Suspect if:
- Increasing WCC (>10x10⁹/L)
- Temperature ≥38.5°C
- Significant clinical change in patient hemodynamics

ACTION:
➡ Send Procalcitonin
➡ Pan-culture if not done in last 24hrs
✓ Start broad-spectrum antibiotics

Viral Myocarditis

Suspect if:
- Significant clinical change in patient hemodynamics
- New heart rhythm

ACTION:
➡ Send Troponin and BNP (if raised consider causes e.g. ischemia, PE)
⊗ Do NOT routinely perform ECG
✓ ICU Doctor to consider POCUS TTE

Other Management Considerations

Management of hypotension and/or low urine output:
Efforts should be made to limit fluid administration where possible due to evidence that patients with COVID-19 may develop worse lung injury with positive fluid balance
- ICU doctor to assess need for further investigations for determination of fluid status
- Minimise crystalloid bolus volumes to 250mL aliquots
- Early institution of vasopressors to reduce fluid requirements
- Consider secondary bacterial infection or viral myocarditis (see above)

Management of change in heart rhythm (in otherwise stable patient):
- Do NOT routinely call for 12-lead ECG
- Do NOT routinely retake blood for electrolytes
- ICU Doctor to assess need for further investigations based on bedside ECG monitoring

Tapering of initial antibiotic therapy:
- Review need for antibiotics started on admission with results of procalcitonin and rationalise or stop where possible

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Notes on Lab Tests / Rationale and References for

D-Dimer *Why are we tracking D-Dimer levels?*	• Moderate evidence in multiple studies that elevation on admission >1000mcg/L is independent risk factor for mortality[1] - OR=18.42 (2.64-128.55; p=0.003) • 168 Wuhan cases: median level in survivors 610mcg/L (highest level 1290), non-survivors median 2120mcg/L (770-5270)[2] • 449 patients in Wuhan: D-Dimer, prothrombin time were positively, and platelet count was negatively, correlated with 28-day mortality in multivariate analysis (D-Dimer >3000mcg/L 52.4%, *P*=0.017). Better prognosis with heparin treatment.[3]
LFTs *LFTs are abnormal in many patients, why not do them daily?*	• Elevation in AST, ALT does not correlate with mortality[4] • Unclear whether a measure of viral load and direct viral liver inflammation or elevations due to drug toxicity, cytokine storm or hypoxemia: seen in 14-53% of patients (2-11% had liver comorbidities)[5]

Ferritin
 	
Why are we tracking Ferritin levels?
	• Conflicting evidence: appears to be higher in more severe cases but not clear if useful predictor of mortality
	  - Median non-survivors 1435 (728-2000) vs 503 (<920)[1]
	  - Correlates with ARDS but not mortality: non-survivors median 1029 (546-2000) vs survivors median 457 (<700)[6]
	• COVID-19 may precipitate a cytokine storm/secondary HLH syndrome (no clear cases yet due to difficulty in diagnosis)[7]: a ferritin of >2000 (HScore) would raise suspicion of this diagnosis and help to highlight cases who may benefit from immunosuppression

Troponin *Why do a troponin on admission and not trend it further?*	• Prognostic but different assays and normal ranges limit external validity • Non-survivors have significantly higher levels but still often within the normal range[1,4]
Procalcitonin *Why check a PCT on admission?*	• Levels <0.5ng/mL in 95% of patients presenting with Covid-19 and does not correlate with severity of disease (using a primary outcome of death/ventilation/ICU admission)[9] • Consider an alternative diagnosis and prioritise standard sepsis treatment if level >0.5ng/mL • Later in course of disease can be used to assess if chance of superadded bacterial infection

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