



## TYPICAL PRESENTATION

### SYMPTOMS

fever (more likely in adults), cough, dyspnea, myalgias, fatigue, anorexia, anosmia, dysgeusia, diarrhea, nausea/ vomiting, abdominal pain, sputum production, headache, hemoptysis, acute pulmonary embolism, subacute thyroiditis

### LABS

lymphocytopenia, decreased albumin, elevated CRP, elevated LDH, elevated ESR, normal procalcitonin

### IMAGING

bilateral ground glass opacities on CT



## KEY GROUPS FOR ATYPICAL PRESENTATION



## RISK FACTORS FOR SEVERE DISEASE, MORBIDITY, AND MORTALITY

### IMMUNOCOMPROMISED

- ON LONG TERM GLUCOCORTICOIDS: longer incubation and viral shedding periods
- ORGAN TRANSPLANTS: may present with more severe symptoms of COVID-19 pneumonia, and also have longer incubation and viral shedding periods
- HIV+ PATIENTS: longer course and slower seroconversion, CT with high density patchy shadows and unclear boundaries in peripheral lung involving interlobar fissures

### CHILDREN

- Less severe than adults
- Less likely to present with fever, shortness of breath or cough than adults
- If symptoms are present, most common: fever, cough, sore throat
- Young children (infants) more susceptible to severe disease than older children
- Common lab findings: thrombocytosis, lymphopenia, neutropenia, elevated CRP, elevated procalcitonin, elevated CK, elevated ALT
- Imaging: Most common radiologic finding is bilateral ground glass opacities and nonspecific unilateral/bilateral lesions on chest CT
- Kawasaki-like presentation is an emerging clinical finding and is discussed on the pediatric infographic

### PREGNANT WOMEN

- Most are asymptomatic or mild.
- Pregnant women with COVID-19 who deliver by C-section are at greater risk for ICU admission as well as NICU admissions for their babies.

### ELDERLY

- Can be asymptomatic
- ICU patients are more likely to be elderly
- Common symptoms are fever, cough, dyspnea, with lymphocytopenia

### SEVERE DISEASE

- Older age, HTN, DM, COPD, cardiovascular disease, cerebrovascular disease, obesity (BMI  $\geq 28 \text{ kg/m}^2$ )
- Mildly elevated WBC count (WMD:  $0.41 \times 10^9/\text{L}$ ), elevated cytokines (IL-2R, IL-6, IL-10, TNF- $\alpha$ ), elevated biomarkers of cardiac and muscle injury, elevated coagulation measures, elevated ALT, AST, BUN, Cr, LDH, CRP, and ferritin
- Elevated procalcitonin associated with a nearly 5-fold higher risk of severe disease

### MORBIDITY









- Elevated neutrophil count
- Increased BUN and LDH related to renal failure, heart failure or multi-organ failure
- Acute cardiac injury 13 times more common in ICU-COVID patients than in non-ICU COVID patients
- Fibrinolysis shutdown (elevated D-Dimer and complete failure of clot lysis at 30 minutes on TEG) predicts thromboembolic events and need for hemodialysis

### MORTALITY

- Age  $>65$  yrs, male sex, CV disease, DM, chronic respiratory disease, dyspnea, ARDS, HTN, cancer, cerebrovascular disease, high SOFA score, leukocytosis, high LDH level, cardiac injury, hyperglycemia, high-dose corticosteroid use, kidney disease, prolonged PT
- Increased fibrin degradation products; D-dimer  $>1$  microgram/mL
- High neutrophil:lymphocyte ratio (especially in males); decreased lymphocytes and platelets
- Significantly elevated WBC count (WMD:  $4.15 \times 10^9/\text{L}$ ), CD3+ CD8+ T cells  $<= 75$  cell/microliter, decreased CD4+ count
- Increased biomarkers for cardiac and muscle injury, inflammation and bacterial infections; increased total bilirubin and creatine kinase
- Cardiac troponin significantly elevated (WMD: 32.7 ng/L)
- Markedly elevated interleukin 6 (IL-6) and serum ferritin (WMD: 4.6 pg/mL and 760.2 ng/mL, respectively)
- AKI during hospitalization



## COMMON COMPLICATIONS

 <p><b>LUNGS</b></p> <ul style="list-style-type: none"> <li>ARDS: 15-33% of cases (8 days after sx onset); increased risk in older age, neutrophilia, increased LDH, increased D-Dimer, age <math>&gt;65</math> yrs, DM, HTN</li> <li>Acute respiratory failure: 8% of cases; leading cause of mortality</li> <li>Pneumonia</li> </ul>	 <p><b>THROMBOTIC</b></p> <ul style="list-style-type: none"> <li>31% incidence of thrombotic complications in one study of 184 pts</li> <li>predisposes to venous and arterial thromboembolic events due to excessive inflammation, hypoxia, immobilization and DIC</li> <li>PE is most frequent thrombotic complication</li> <li>Age and coagulopathy (PT<math>&gt;3</math>s, APTT<math>&gt;5</math>s) are independent predictors</li> </ul>
 <p><b>CARDIO-VASCULAR</b></p> <ul style="list-style-type: none"> <li>Reported in 7-20% of cases. Prevalence high among patients who are severely ill</li> <li>Vascular inflammation cardiac arrhythmias, myocarditis, cardiomyopathy, acute onset heart failure, MI, cardiac arrest</li> <li>Less common: myocarditis, cardiac tamponade, fulminant myocarditis</li> <li>1 case of ITP</li> </ul>	 <p><b>KIDNEY</b></p> <ul style="list-style-type: none"> <li>Low prevalence, but is a marker of multi organ failure and severe disease</li> <li>40% pts with proteinuria and 26% with hematuria on admission</li> <li>5% pts developed AKI and increased hospital mortality</li> <li>Stage 3 AKI in 50% of pts; rhabdomyolysis, metabolic acidosis, and hyperkalemia</li> <li>Old age, DM, severe illness, and positive fluid balance are associated factors</li> </ul>
 <p><b>LIVER</b></p> <ul style="list-style-type: none"> <li>Reported in 14-53% of cases</li> <li>Abnormal aminotransferase levels in patients with severe illness (AST and ALT <math>&gt;40</math>)</li> <li>Clinically significant liver injury is uncommon</li> </ul>	 <p><b>NEUROLOGIC</b></p> <ul style="list-style-type: none"> <li>Viral invasion of CNS in patients with severe illness</li> <li>Observed in 36% of 214 patients in one study</li> <li>Acute CVA disease, impairment of consciousness, ataxia, seizures, and encephalopathy; prognosis is poor for these patients</li> </ul>
 <p><b>INFECTION</b></p> <ul style="list-style-type: none"> <li>Sepsis and septic shock reported in 4-8% of cases</li> <li>Secondary infection reported in 6-10% of cases; staph and strep are common</li> <li>DIC: cytokine release syndrome with persistent fevers, increased ferritin, D-dimer, and proinflammatory cytokines</li> </ul>	 <p><b>PREGNANCY</b></p> <ul style="list-style-type: none"> <li>Fetal distress, premature labor, newborn thrombocytopenia, elevated liver enzymes, respiratory distress</li> <li>Miscarriage, IUGR, and preterm birth</li> <li>1 case of stillbirth</li> </ul>