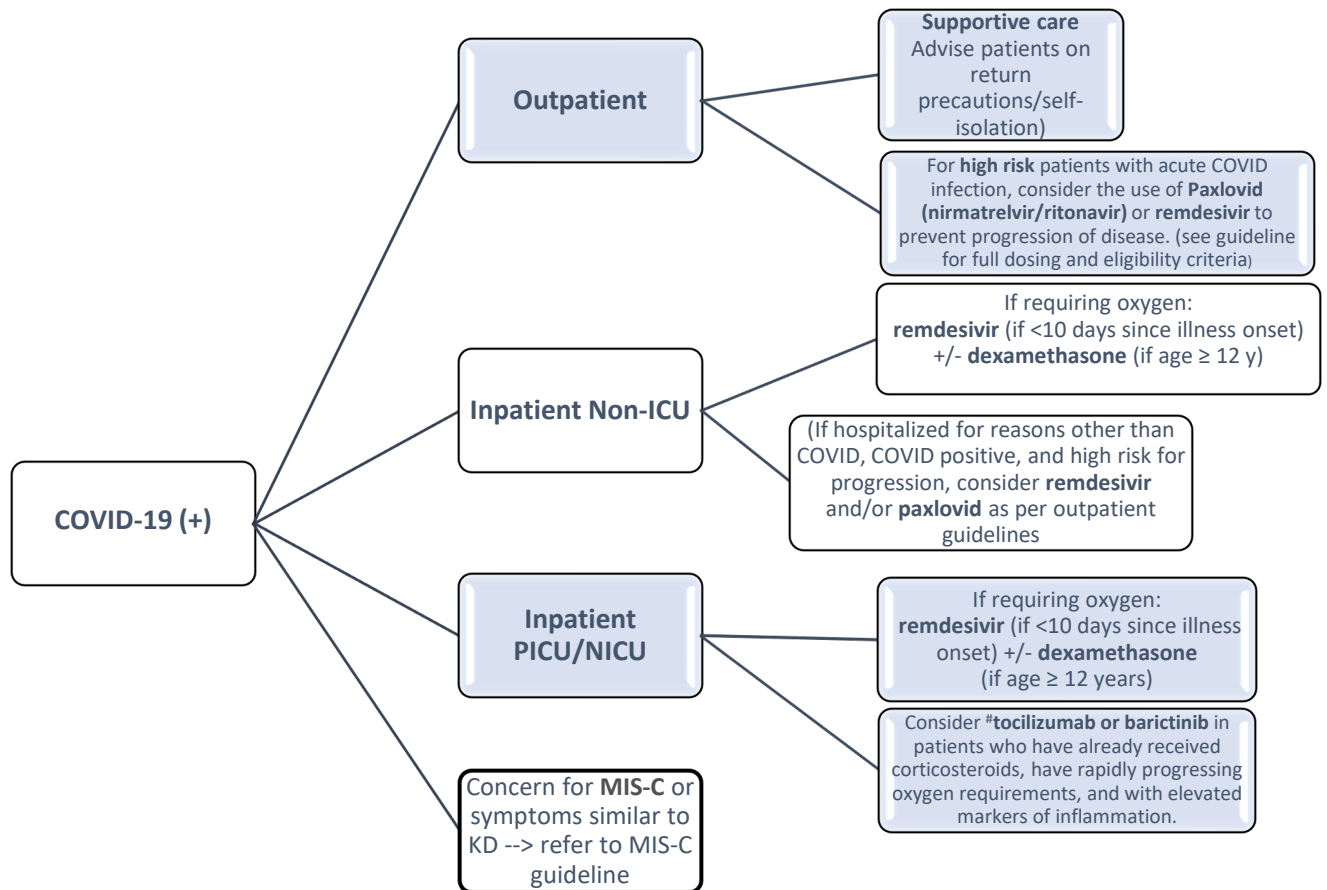


# COVID Pediatric Treatment Guidelines

Below are recommendations for management of pediatric patients with suspected or documented COVID-19.

These guidelines will be updated periodically.



Prioritization of High-risk pediatric patients	
Tier 1 (Highest risk)	<p>Immunocompromised individuals not expected to mount an adequate immune response to COVID vaccination, regardless of vaccine status</p> <p>(Highest priority are severely immunosuppressed, including: patients receiving B-cell depleting therapies such as rituximab, patients receiving Bruton tyrosine kinase inhibitors, CAR-T recipients, post stem cell transplant &lt;2 years or on immunosuppressive therapy, hematologic or solid tumor malignancies on active therapy, solid organ therapy on immunosuppression, moderate to severe primary immunodeficiency (e.g., SCID, DiGeorge, CVID, Wiskott Aldrich), patients with advanced HIV (CD4 T cell count &lt;200 or other manifestations of advanced HIV), on high dose corticosteroids for ≥2 weeks (defined as 20mg prednisone or equivalent per day))</p>
Tier 2	<p>Multiple risk factors and no immunity (vaccination not up to date, no recent infection: defined as in the last 4 months)</p> <p><b>Definite high risk conditions:</b> Severely immunocompromised, chronic lung disease excluding asthma, chronic cardiac condition, prematurity, neurologic disease, obesity, diabetes mellitus, medical technology dependence (i.e., tracheostomy, ventilator usage)</p> <p><b>Probable high risk conditions:</b> sickle cell disease, mild-moderate immunocompromised, neuro-disabilities, chronic kidney, GI or liver disease.</p>
Tier 3 See risk factors in Tier 2	Multiple risk factors and prior immunity (vaccination up to date or recent infection: defined as in the last 4 months)
Tier 4 See risk factors in Tier 2	Single risk factor and no immunity (vaccination not up to date, no recent infection: defined as in the last 4 months)
Tier 5 See risk factors in Tier 2	Single risk factor and prior immunity (vaccination up to date or recent infection: defined as in the last 4 months)

**Definite high risk conditions:** Severely immunocompromised, chronic lung disease excluding asthma, chronic cardiac condition, prematurity, neurologic disease, obesity, diabetes mellitus

**Probable high risk conditions:** sickle cell disease, mild-moderate immunocompromised, neuro-disabilities, chronic kidney, GI or liver disease.

## Outpatient Therapeutic Agents

Agents	Criteria for use	Drug Information and Dosing												
<b>Remdesivir (IV only)</b>	Eligibility: -Pediatric patients <b>weighing ≥ 1.5kg</b> with <u>mild-moderate COVID</u> who are not requiring hospitalization for COVID-19 and are <b>at high risk for progression of disease</b> -Onset of disease within <b>7 days</b> -Recommended for <b>high risk patients</b> (as defined above), with most benefit likely to be seen in <b>children aged &lt;1 year or 12-17 years but can be considered in 1-12 years</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #2c3e50; color: white;">Body Weight</th> <th style="background-color: #2c3e50; color: white;">Loading dose (Day 1)</th> <th style="background-color: #2c3e50; color: white;">Maintenance dose (from Day 2)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>1.5 to &lt;3 kg</b></td> <td style="text-align: center;">2.5mg/kg x 1</td> <td style="text-align: center;">1.25mg/kg/dose on days 2-3</td> </tr> <tr> <td style="text-align: center;"><b>3 to &lt; 40 kg</b></td> <td style="text-align: center;">5mg/kg IV x1</td> <td style="text-align: center;">2.5mg/kg IV daily on days 2-3</td> </tr> <tr> <td style="text-align: center;"><b>≥ 40 kg and adults</b></td> <td style="text-align: center;">200mg IV x1</td> <td style="text-align: center;">100mg IV daily on days 2-3</td> </tr> </tbody> </table> <p><b>Important notes:</b></p> <ul style="list-style-type: none"> <li><b>A 3 day duration</b> is recommended for patients who are not hospitalized or hospitalized for reasons other than COVID-19.</li> <li>Must be administered in a setting where patients can be observed for at least 1 hour after infusion</li> <li>Use caution in patients with eGFR &lt;30mL/minute</li> <li>Baseline LFTs, creatinine are recommended prior to initiation of treatment</li> </ul>	Body Weight	Loading dose (Day 1)	Maintenance dose (from Day 2)	<b>1.5 to &lt;3 kg</b>	2.5mg/kg x 1	1.25mg/kg/dose on days 2-3	<b>3 to &lt; 40 kg</b>	5mg/kg IV x1	2.5mg/kg IV daily on days 2-3	<b>≥ 40 kg and adults</b>	200mg IV x1	100mg IV daily on days 2-3
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<b>Paxlovid (combination of Nirmatrelvir and Ritonavir)</b>	Eligibility: -Pediatric patients <b>≥12 years old and weighing ≥ 40kg</b> with <u>mild-moderate COVID</u> (through EUA) who are not requiring hospitalization for COVID-19 and <b>are at high risk for</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #2c3e50; color: white;">Agent</th> <th style="background-color: #2c3e50; color: white;">Dosing</th> <th style="background-color: #2c3e50; color: white;">Duration</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>Nirmatrelvir Ritonavir</b> <i>(They are provided together within a 5 day dose pack)</i></td> <td style="text-align: center;">2 tablets PO twice a day 1 tablet PO twice a day <i>Both medications should be taken at the same time</i></td> <td style="text-align: center;">5 days</td> </tr> </tbody> </table> <p><b>Important notes:</b></p> <ul style="list-style-type: none"> <li>Please provide the Fact Sheet for Patients, Parents, and Caregivers to the family and document in the chart <a href="https://www.fda.gov/media/155051/download">https://www.fda.gov/media/155051/download</a></li> <li>Drug-drug interactions are common due to ritonavir being a P450 3A4 inhibitor, so other medications should be reviewed closely for possible interactions</li> <li>Patients with moderate renal impairment may need dosing adjustment</li> </ul>	Agent	Dosing	Duration	<b>Nirmatrelvir Ritonavir</b> <i>(They are provided together within a 5 day dose pack)</i>	2 tablets PO twice a day 1 tablet PO twice a day <i>Both medications should be taken at the same time</i>	5 days						
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	<p><b>progression of disease</b></p> <ul style="list-style-type: none"> <li>-Onset of disease within <b>5 days</b></li> <li>-Recommended for <b>high risk</b> patients (as defined above)</li> <li>-Contraindicated in patients with severe renal impairment (eGFR of &lt;30 mL/min or severe hepatic impairment)</li> </ul>	<ul style="list-style-type: none"> <li>• Common side effects: dysgeusia, diarrhea, hypertension, myalgia</li> <li>• May take with or without food; tablets need to be swallowed whole (cannot be crushed)</li> </ul>
<p><b>Monoclonal antibodies (IV only)</b></p>	<p><b>NO CURRENT MONOCLONAL ANTIBODIES RECOMMENDED</b></p>	

## Inpatient Treatment of Patients with Symptomatic COVID-19 infection

(For patients with acute COVID infection that are hospitalized for other reasons but are at high risk of progression, consider the use of one of the outpatient therapies as listed above)

Agents	Criteria for use	Drug Information and Dosing												
<b>Remdesivir (IV only)</b>	<p>Eligibility: -Hospitalized children with symptomatic COVID-19 <b>requiring any supplemental oxygen</b> and weighing <math>\geq 1.5</math>kg</p> <p>-Highest benefit in patients aged <math>\geq 12</math> yrs, onset of disease <math>\leq 10</math> days prior, and at risk for progression to critical COVID-19</p> <p>-Unlikely to be helpful for infants with bronchiolitis or croup due to COVID-19</p>	<table border="1"> <thead> <tr> <th>Body Weight</th> <th>Loading dose (Day 1)</th> <th>Maintenance dose (from Day 2)</th> </tr> </thead> <tbody> <tr> <td><b>1.5 to &lt;3 kg</b></td> <td>2.5mg/kg x 1</td> <td>1.25mg/kg/dose on days 2-5</td> </tr> <tr> <td><b>3kg to &lt; 40 kg</b></td> <td>5mg/kg IV x1</td> <td>2.5mg/kg IV daily for days 2-5</td> </tr> <tr> <td><b><math>\geq 40</math> kg and adults</b></td> <td>200mg IV x1</td> <td>100mg IV daily for days 2-5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• <b>Duration of therapy:</b> <u>5 days</u> or until patient is discharged. For patients otherwise ready to discharge, do not delay discharge to complete remdesivir course.</li> <li>• Can consider extending treatment to <u>10 days in patients who are immunocompromised or severely ill</u></li> <li>• Use caution in patients with eGFR <math>&lt; 30</math> mL/minute</li> <li>• Baseline LFTs, creatinine, and coags are recommended prior to initiation of treatment; follow LFTs while on treatment</li> </ul>	Body Weight	Loading dose (Day 1)	Maintenance dose (from Day 2)	<b>1.5 to &lt;3 kg</b>	2.5mg/kg x 1	1.25mg/kg/dose on days 2-5	<b>3kg to &lt; 40 kg</b>	5mg/kg IV x1	2.5mg/kg IV daily for days 2-5	<b><math>\geq 40</math> kg and adults</b>	200mg IV x1	100mg IV daily for days 2-5
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<b>Corticosteroids</b>	<p>Eligibility: -Hospitalized children with COVID-19 <b>who are requiring oxygen through high-flow device, non-invasive or invasive ventilation</b></p> <p>-Most likely to benefit patients <math>\geq 12</math> years</p>	<table border="1"> <thead> <tr> <th>Agent</th> <th>Dosing</th> <th>Maximum Dose</th> </tr> </thead> <tbody> <tr> <td><b>Dexamethasone (preferred)</b></td> <td>0.15m/kg IV/PO daily</td> <td>6mg</td> </tr> <tr> <td><b>Alternatives with glucocorticoid equivalency to dexamethasone</b></td> <td><b>Prednisolone/Prednisone</b> 1mg/kg PO/NG daily  <b>Methylprednisolone</b> 0.8mg/kg IV daily</td> <td>32 mg</td> </tr> <tr> <td><b>Preterm infants with corrected gestational age of &lt; 40 weeks</b></td> <td><b>Hydrocortisone</b> 0.5mg/kg every 12 hours for 7 days then 0.5mg/kg daily for 3 days</td> <td>-</td> </tr> </tbody> </table> <p><b>Duration of treatment:</b> <u>10 days</u> or until patent is discharged</p>	Agent	Dosing	Maximum Dose	<b>Dexamethasone (preferred)</b>	0.15m/kg IV/PO daily	6mg	<b>Alternatives with glucocorticoid equivalency to dexamethasone</b>	<b>Prednisolone/Prednisone</b> 1mg/kg PO/NG daily  <b>Methylprednisolone</b> 0.8mg/kg IV daily	32 mg	<b>Preterm infants with corrected gestational age of &lt; 40 weeks</b>	<b>Hydrocortisone</b> 0.5mg/kg every 12 hours for 7 days then 0.5mg/kg daily for 3 days	-
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<p><b>Tocilizumab</b></p> <p>Drug class: IL-6 receptor inhibitor</p>	<p>Eligibility: -Available for <b>children ≥2 years old</b> through EUA to treat COVID-19</p> <p>- Used for patients with acute COVID infection <b>within 24 hours of ICU admission or exhibiting respiratory deterioration with elevated CRP (&gt;7.5mg/dL)</b> and receiving oxygen through high flow nasal cannula or non-invasive or invasive ventilation</p> <p>-Should be used <u>in combination with steroids</u></p> <p>-Needs ID approval</p>	<table border="1" data-bbox="613 205 1203 394"> <thead> <tr> <th>Body Weight</th> <th>Dose</th> </tr> </thead> <tbody> <tr> <td>&lt; 30 kg</td> <td>12mg/kg IV x 1</td> </tr> <tr> <td>≥ 30 kg</td> <td>8mg/kg IV x 1 (max 800mg)</td> </tr> </tbody> </table> <p>Important notes:</p> <ul style="list-style-type: none"> <li>• Please provide the Fact Sheet for Patients, Parents, and Caregivers to the family and document in the chart <a href="https://www.gene.com/download/pdf/actemra_eua_patient_fact_sheet.pdf">https://www.gene.com/download/pdf/actemra_eua_patient_fact_sheet.pdf</a></li> <li>• Send quantiferon Gold and Hepatitis B serologies (unless vaccinated previously) prior to initiation of treatment (do not need to wait for results before starting)</li> <li>• Daily CBC, CMP recommended while receiving this treatment</li> <li>• Should not administer this treatment if any live attenuated vaccine given within the last 2 weeks</li> <li>• See table below for adverse reactions</li> </ul>	Body Weight	Dose	< 30 kg	12mg/kg IV x 1	≥ 30 kg	8mg/kg IV x 1 (max 800mg)			
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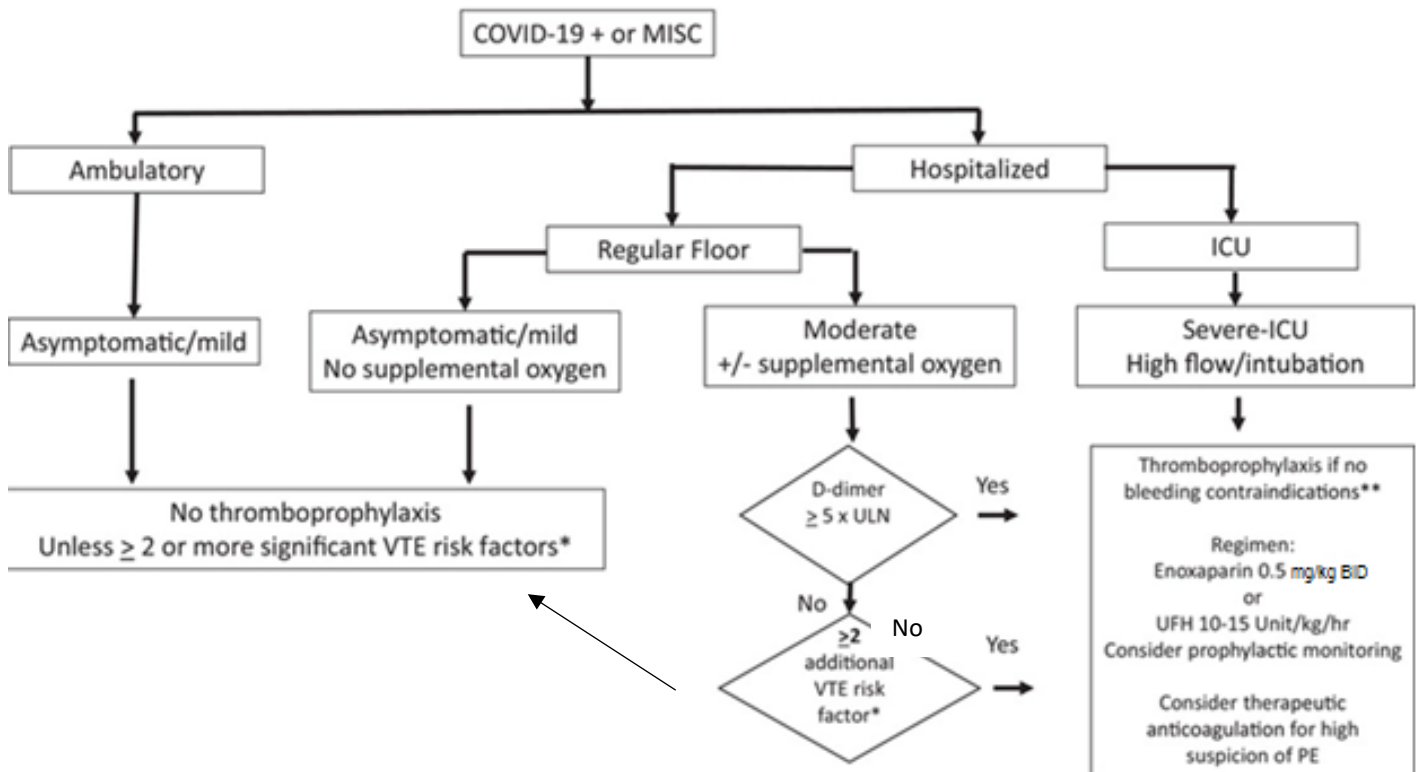
## Anticoagulation

### Recommended

- refer to treating provider to assess for therapeutic appropriateness and safety of anticoagulation
- COVID-19 (+) patients should routinely be monitored for risk of thrombosis

### Anticoagulation guidelines for COVID-19 and MIS-C. Adapted from Sharathkumar et al. *Pediatr Blood Cancer*. 2021 Jul; 68(7).

#### Framework for thromboprophylaxis assessment in children



#### Recommendations for anticoagulation:

##### Non-PICU admission

Recommend no thromboprophylaxis unless:

1. Patient requiring oxygen AND D dimer  $\geq 5$  times the upper limit of normal OR
2.  $\geq 2$  additional venous thromboembolism (VTE) risk factors: MIS-C, age  $\geq 12$  years, obesity, complete immobilization, central line, estrogen therapy, family history of VTE

In which case **prophylactic** management with **enoxaparin** or **unfractionated heparin** (UH) should be used.

##### PICU admission

Recommend **prophylactic** management with **enoxaparin** or **unfractionated heparin** for all COVID-19 patients unless otherwise contraindicated (platelet count  $< 50,000$ , fibrinogen  $< 100\text{mg/dL}$ , major bleeding). Consider hematology consult but do not delay initiation of anticoagulation.

- Once patient is stable for transfer to ward, can usually be discontinued unless they meet any of the criteria listed above (for non-PICU admission).

<b>Hematology consult</b>	<ul style="list-style-type: none"> <li>• Rapidly increasing D-dimers</li> <li>• History of VTE</li> <li>• Patients with significant underlying medical conditions (i.e., malignancy, sickle cell disease or other hemoglobinopathy, cardiac disease, nephrotic syndrome, CF, autoimmune disease)Patients with suspected or confirmed venous thrombo-embolism or pulmonary embolus</li> </ul>
<b>Discharge recommendations</b>	<ul style="list-style-type: none"> <li>• Consider stopping anticoagulation at time of discharge unless patient has known thrombus, central line, D dimer remains <math>\geq 5</math> times the upper limit of normal, or other medical conditions. In those situations, <b>please consult with pediatric hematology and arrange for outpatient follow up if recommended.</b> May need an additional 1-2 week course of anticoagulation, or until risk factors no longer present.</li> </ul>
<p>* For patients who do not meet requirements or are contraindicated for use with enoxaparin or UH, consider early ambulation and/or the use of sequential compression devices.</p> <p>*If patients were previously on prophylactic dosing of enoxaparin or UH, they should be increased to treatment dosing</p> <p>*For initiation of heparin in COVID-19 patients, consult hematology and pharmacy to dose.</p>	

Enoxaparin (Lovenox)	
<b>Prophylactic Dosing</b>	<ul style="list-style-type: none"> <li>• 1 to &lt; 2 months: 0.75mg/kg SQ every 12 hours</li> <li>• <sup>3</sup> 2 months: 0.5mg/kg SQ every 12 hours</li> <li>• Crcl &lt; 30ml/min: 0.5mg/kg SQ every 24 hours or consider using heparin</li> </ul>
<b>Monitoring</b>	<p>CBC, serum creatinine, LMWH Anti-xa assay</p> <p>Enoxaparin target peak levels (drawn 4-6 hours post second dose):</p> <ul style="list-style-type: none"> <li>• Prophylaxis: 0.1 - 0.3 units/mL (Treatment: 0.5 to 1 units/mL)</li> </ul>
<b>Caution/contraindications</b>	<ul style="list-style-type: none"> <li>• Hypersensitivity to enoxaparin</li> <li>• Active bleeding, major surgery, trauma</li> <li>• History of heparin Induced Thrombocytopenia/Thrombosis (HITT)</li> </ul>
<b>Black Box Warning</b>	<ul style="list-style-type: none"> <li>• Spinal/epidural hematoma may occur in patients receiving enoxaparin and neuraxial anesthesia or undergoing spinal puncture</li> </ul>

Anti-infective Agent	Monitoring parameters & clinical pearls
Remdesivir	<p><u>Adverse Events:</u></p> <ul style="list-style-type: none"> <li>• <b>Hepatic function:</b> Self-limiting, reversible hepatotoxicity has been observed, which resolved after therapy cessation. Hepatic laboratory testing should be performed in all patients at baseline and routinely. No dose adjustments are provided. Discontinue therapy if ALT increases &gt; 10x ULN. May resume therapy when ALT is &lt; 5x ULN.</li> <li>• <b>Renal function:</b> Remdesivir is not recommended in adult and pediatric patients (greater than 28 days old) with eGFR less than 30 mL/min or in full-term neonates (at least 7 days to less than or equal to 28 days old) with serum creatinine greater than or equal to 1 mg/dL unless the potential benefit outweighs the potential risk. Remdesivir contains excipient sulfobutylether-beta-cyclodextrin sodium salt (SBECD) which may accumulate in renal impairment. However, SBECD is readily removed by hemodialysis and renal replacement therapies. Remdesivir should not be withheld in renal impairment given the clinical insignificance of SBECD in a short course of therapy.</li> </ul> <p><u>Metabolism:</u> Remdesivir is a prodrug metabolized via CYP3A4, concomitant CYP3A4 inhibitors should be avoided if possible.</p>
Corticosteroids	<p><u>Adverse Events:</u></p> <ul style="list-style-type: none"> <li>• Hyperglycemia</li> <li>• Secondary infections</li> <li>• Reactivation of latent infections</li> <li>• Psychiatric disturbances</li> <li>• Adrenal insufficiency</li> <li>• Increased blood pressure</li> <li>• Peripheral edema</li> </ul> <p><u>Monitoring:</u> Blood glucose, blood pressure, signs and symptoms of new infection</p>
Monoclonal antibodies	<p><u>Adverse Events/Monitoring:</u></p> <ul style="list-style-type: none"> <li>• Potential for severe hypersensitivity reaction including <b>anaphylaxis</b>. Discontinue medication immediately and provide supportive medications.</li> <li>• Infusion related reactions fever, chills, nausea, hypotension, angioedema, pruritus, rash, myalgia can occur.</li> <li>• If a patient experiences an adverse effect, please report to FDA Medwatch, instructions for doing so can be found at the following <a href="#">link</a>.</li> </ul>
Baricitinib	<p>Black box warning: Serious infections, malignancy, thrombosis</p> <p><u>Adverse Events/Monitoring:</u></p> <ul style="list-style-type: none"> <li>• GI perforations</li> <li>• Hematologic toxicity, do not initiate in patients with an absolute lymphocyte count &lt; 500 cells/mm<sup>3</sup>, ANC &lt; 1000 cells/mm<sup>3</sup>, or hemoglobin &lt; 8 g/dL</li> <li>• Hepatic effects – elevated liver enzymes. Monitor LFTs at baseline and periodically</li> <li>• Hypersensitivity</li> <li>• Lipid abnormalities</li> </ul>
Tocilizumab	<p>Black box warning: serious infections (ex. tuberculosis, invasive fungal infections, opportunistic pathogens)</p> <p><u>Adverse events/monitoring:</u></p> <ul style="list-style-type: none"> <li>• GI perforation</li> <li>• Malignancy</li> <li>• Hematologic effects (neutropenia, thrombocytopenia)</li> <li>• Hepatic injury (use with caution in patients with hepatic impairment)</li> <li>• Hyperlipidemia</li> <li>• Hypersensitivity</li> </ul>

## References:

1. Holshue ML, DeBolt C, Lindquist S, et al. First Case of 2019 Novel Coronavirus in the United States. *N Engl J Med*. 2020; 382 (10):929-936.
2. Wang, M., Cao, R., Zhang, L. et al. Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. *Cell Res* 30, 269–271 (2020). [doi.org/10.1038/s41422-020-0282-0](https://doi.org/10.1038/s41422-020-0282-0).
3. Yixian, S et al. Expert Consensus on Chloroquine Phosphate for New Coronavirus Pneumonia. *Chin J Tuberc Respir Dis*, 2020,43: Epub ahead of print. DOI: 10.3760/cma.j.issn.1001-0939.2020.0019.
4. Gao J, Tian Z, Yang X. Breakthrough: Chloroquine phosphate has shown apparent efficacy in treatment of COVID-19 associated pneumonia in clinical studies. *Biosci Trends*. 2020;P1-P2.
5. Landscape analysis of therapeutics as 17 February 2020. World Health Organization, February 17, 2020. [https://www.who.int/blueprint/priority-diseases/key-action/Table\\_of\\_therapeutics\\_Appendix\\_17022020.pdf?ua=1](https://www.who.int/blueprint/priority-diseases/key-action/Table_of_therapeutics_Appendix_17022020.pdf?ua=1). Accessed 3/4/2020.
6. WHO R&D Blueprint Informal consultation on prioritization of candidate therapeutic agents for use in novel coronavirus 2019 infection: Draft January 24, 2020. World Health Organization, January 27, 2020. <https://apps.who.int/iris/bitstream/handle/10665/330680/WHO-HEO-RDBlueprint%28nCoV%29-2020.1-eng.pdf?ua=1>. Accessed 3/2/2020.
7. Coleman CM, Sisk JM, Mingo RM, Nelson EA, White JM, Frieman MB. Abelson Kinase Inhibitors Are Potent Inhibitors of Severe Acute Respiratory Syndrome Coronavirus and Middle East Respiratory Syndrome Coronavirus Fusion. *J Virol*. 2016;90(19):8924-33.
8. Xu K, Cai H, Shen Y, et al. [Management of corona virus disease-19 (COVID-19): the Zhejiang experience]. *Zhejiang Da Xue Xue Bao Yi Xue Ban*. 2020;49(1)
9. Tan EL, Ooi EE, Lin CY, et al. Inhibition of SARS coronavirus infection in vitro with clinically approved antiviral drugs. *Emerging Infect Dis*. 2004;10(4):581-6.
10. Li H, Wang YM, Xu JY, Cao B. [Potential antiviral therapeutics for 2019 Novel Coronavirus]. *Zhonghua Jie He He Hu Xi Za Zhi*. 2020;43:E002.
11. Vincent MJ, et al. Chloroquine is a potent inhibitor of SARS coronavirus infection and spread. *Virology Journal*. 2005, 2:69. doi:10.1186/1743-422X-2-69
12. Colson P, et al. Chloroquine and hydroxychloroquine as available weapons to fight COVID-19. *International Journal of Antimicrobial Agents*. 2020.
13. Trissel, LA, Ashworth LD, Ashworth J. *Trissel's Stability of Compounded Formulations*. 6th ed. Washington, DC: American Pharmacists Association; 2018.
14. McHenry AR, Wempe MF, Rice PJ; Stability of extemporaneously prepared Hydroxychloroquine 25 mg/ml suspension in plastic bottles and syringes. *IJPC* 2017;21(3):251-254.
15. Klein CE, Chiu YL, Awni W, et al. The tablet formulation of lopinavir/ritonavir provides similar bioavailability to the soft-gelatin capsule formulation with less pharmacokinetic variability and diminished food effect. *J Acquir Immune Defic Syndr*. 2007;44(4):401-10.
16. Huesgen E, Desear KE, Egelund EF, Smith R, Max B, Janelle J. A HAART-Breaking Review of Alternative Antiretroviral Administration: Practical Considerations with Crushing and Enteral Tube Scenarios. *Pharmacotherapy*. 2016;36(11):1145-1165.
17. Biopharmaceutical, M., & Sciences, G. (2018). *Summaries-of-Evidence-Experimental-Therapeutics*, (October). Retrieved from <https://www.who.int/ebola/drc-2018/summaries-of-evidence-experimental-therapeutics.pdf?ua=1>
18. Chan, K. S., Lai, S. T., Chu, C. M., Tsui, E., Tam, C. Y., Wong, M. M. L., ... Yuen, K. Y. (2003). Treatment of severe acute respiratory syndrome with lopinavir/ritonavir: A multicentre retrospective matched cohort study. *Hong Kong Medical Journal*, 9(6), 399–406.
19. Colson, P., Rolain, J.-M., Lagier, J.-C., Brouqui, P., & Raoult, D. (2020). Chloroquine and hydroxychloroquine as available weapons to fight COVID-19. *International Journal of Antimicrobial Agents*, 105932. <https://doi.org/10.1016/j.ijantimicag.2020.105932>
20. Yao, X., Ye, F., Zhang, M., Cui, C., Huang, B., Niu, P., ... Clinical, D. (n.d.). In Vitro Antiviral Activity and Projection of Optimized Dosing Design of Hydroxychloroquine for the Treatment of Severe Acute Respiratory Syndrome Main point: Hydroxychloroquine was found to be more potent than chloroquine at inhibiting SARS-CoV-2 in vit, 2, 1–25.
21. Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., ... Wei, Y. (2020). Articles Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan , China : a retrospective cohort study. *The Lancet*, 6736(20), 1–9. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)
22. Peter Horby, WeiShen Lim, Jonathan Emberson, Marion Mafham, Jennifer Bell, Louise Linsell, Natalie Staplin, Christopher Brightling, Andrew Ustianowski, Einas Elmahi, Benjamin Prudon, Christopher Green, Timothy Felton, David Chadwick, Kanchan Rege, Christopher Fegan, Lucy C Chappell, Saul

- N Faust, Thomas Jaki, Katie Jeffery, Alan Montgomery, Kathryn Rowan, Edmund Juszcak, J Kenneth Baillie, Richard Haynes, Martin J Landray, RECOVERY Collaborative Group. Effect of Dexamethasone in Hospitalized Patients with COVID-19: Preliminary Report. medRxiv 2020.06.22.20137273; doi: <https://doi.org/10.1101/2020.06.22.20137273>
23. <https://www.covid19treatmentguidelines.nih.gov>
  24. CDC COVID-19 Response Team. Coronavirus Disease 2019 in Children — United States, February 12–April 2, 2020. MMWR Morbidity and Mortality Weekly Report. ePub: 6 April 2020. DOI: <http://dx.doi.org/10.15585/mmwr.mm6914e4>external icon
  25. Lu X, Zhang L, Du H, et al. SARS-CoV-2 Infection in Children. *New England Journal of Medicine*
  26. Dong Y, Mo X, Hu Y, et al. Epidemiological Characteristics of 2143 Pediatric Patients With 2019 Coronavirus Disease in China. *Pediatrics*
  27. Tang N, Bai H, Chen X, et al. Anticoagulant treatment is associated with decreased mortality in severe coronavirus disease 2019 patients with coagulopathy.2020;Doi:10.1111/JTH.14817
  28. Food and Drug Administration. Fact sheet for healthcare providers: emergency use authorization (EUA) of bamlanivimab. 2020. Available at: <https://www.fda.gov/media/143603/download>.
  29. Chen P, Nirula A, Heller B, et al. SARS-CoV-2 neutralizing antibody LY-CoV555 in outpatients with COVID-19. *N Engl J Med*. 2020;Published online ahead of print. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/33113295>.
  30. National Institute of Allergy and Infectious Diseases. Statement—NIH-sponsored ACTIV-3 trial closes LY-CoV555 sub-study. 2020. Available at: <https://www.niaid.nih.gov/news-events/statement-nih-sponsored-activ-3-trial-closes-ly-cov555-sub-study>.
  31. Adamsick ML, Gandhi RG, Bidell MR, et al. Remdesivir in Patients with Acute or Chronic Kidney Disease and COVID-19. *JASN*, vol. 31, no. 7, July 31, 2020, pp. 1384-1386. doi:10.1681/ASN.2020050589.
  32. D. M. Weinreich, S. Sivapalasingam, T. Norton, S. Ali, H. Gao, R. Bhole, B. J. Musser, Y. Soo, D. Rofail, J. Im, C. Perry, C. Pan, R. Hosain, A. Mahmood, J. D. Davis, K. C. Turner, A. T. Hooper, J. D. Hamilton, A. Baum, C. A. Kyrtasous, Y. Kim, A. Cook, W. Kampman, A. Kohli, Y. Sachdeva, X. Graber, B. Kowal, T. DiCioccio, N. Stahl, L. Lipsich, N. Braunstein, G. Herman, G. D. Yancopoulos; Trial Investigators, REGN-COV2, a Neutralizing Antibody Cocktail, in Outpatients with Covid-19. *N. Engl. J. Med.* NEJMoa2035002 (2020). doi:10.1056/NEJMoa2035002 Medline
  33. Kalil AC, Patterson TF, Mehta AK et al (2020) Baricitinib plus remdesivir for hospitalized adults with Covid-19. *N Engl J Med*; NEJMoa2031994. <https://doi.org/10.1056/NEJMoa2031994>
  34. Chen P, Nirula A, Heller B, et al. SARS-CoV-2 Neutralizing Antibody LY-CoV555 in Outpatients with Covid-19. *N Engl J Med* 2021; 384(3): 229-37.
  35. ACTIV-3/TICO LY-CoV555 Study Group, Grund B, Barkauskas CE, et al. A Neutralizing Monoclonal Antibody for Hospitalized Patients with Covid-19. *N Engl J Med* 2020.
  36. U.S. Food and Drug Administration. Fact Sheet for Health Care Providers: Emergency Use Authorization (EUA) of Bamlanivimab and Etesevimab. Available at: <https://www.fda.gov/media/145802/download>.
  37. Weinreich DM, Sivapalasingam S, Norton T, et al. REGN-COV2, a Neutralizing Antibody Cocktail, in Outpatients with Covid-19. *N Engl J Med*. 2021;384(3):238-251. doi:10.1056/NEJMoa2035002
  38. REMAP-CAP Investigators, Gordon AC, Mouncey PR, et al. Interleukin-6 receptor antagonists in critically ill patients with COVID-19. *N Engl J Med*. 2021..
  39. RECOVERY Collaborative Group, Horby PW, Pessoa-Amorim G, et al. Tocilizumab in patients admitted to hospital with COVID-19 (RECOVERY): preliminary results of a randomised, controlled, open-label, platform trial. *medRxiv*. 2021;preprint.
  40. “Reactions and Adverse Events of the Pfizer-BioNTech COVID-19 Vaccine.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 14 May 2021, [www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/reactogenicity.html](http://www.cdc.gov/vaccines/covid-19/info-by-product/pfizer/reactogenicity.html).
  41. “Emergency Use Authorization (EUA) Amendment for an Unapproved Product Review Memorandum.” *Centers for Disease Control and Prevention*, [www.fda.gov/media/148542/download](http://www.fda.gov/media/148542/download).
  42. Sharathkumar AA, Faustino EVS, Takemoto CM. How we approach thrombosis risk in children with COVID-19 infection and MIS-C. *Pediatr Blood Cancer*. 2021;68(7):e29049. doi:10.1002/pbc.29049

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