COVID-19 Antiviral and Pharmacotherapy Information

**Supportive therapy is the cornerstone of treatment.** No antiviral therapy option can currently be recommended in addition to supportive care, nor should any be considered comparatively superior for SARS-CoV-2 given the available data. It is also unclear at this time whether multidrug regimens provide any additional benefit in the treatment of COVID-19. Given the current lack of data over monotherapy regimens and the added toxicity of multidrug regimens, it is very unlikely that multidrug combinations will produce a favorable risk/benefit ratio.

Antiviral therapy should only be considered in patients with confirmed infection. Therapies below have been tiered based on the available data, current availability, toxicity profile, and practical considerations specific to the Nebraska Medical Center. Updates are expected during this fluid situation.

### Preferential (clinical trial enrollment):

» Remdesivir Clinical Trial (NCT04280705) – E-mail Andre Kalil (akalil@unmc.edu) and LuAnn Larson (llarson@unmc.edu) for evaluation
- **Dosing:** 200mg IV once, then 100mg IV daily for duration of hospitalization or up to 10 total days
- **Adverse Effects:** Generally mild severity - GI intolerances, LFT abnormalities, infusion-related reactions
- **Inclusion Criteria:** Age ≥18, PCR confirmed SARS-CoV-2 infection within past 3 days, one of: 1) infiltrates on chest imaging 2) requiring supplemental oxygen or mechanical ventilation 3) respiratory physical exam findings and SpO₂ ≤ 94% on RA
- **Exclusion Criteria:** AST or ALT >5x ULN, eGFR<50 or on dialysis, pregnancy or breast feeding, anticipated discharge within 3 days

### Situational (alphabetical order): Risk/benefit ratio may favor use in selected patients. ID consultation required.

» Remdesivir Expanded Access (NCT04323761) – This program is being transitioned from an eIND-requiring compassionate use protocol to an IRB-approved expanded access program and may not currently be available for enrollment. The UNMC Clinical Research Center (llarson@unmc.edu) can be contacted for the latest status.
- **Dosing:** 200mg IV once, then 100mg IV daily for up to 10 total days
- **Adverse Effects:** Generally mild severity – GI intolerances, LFT abnormalities, infusion-related reactions
- **Inclusion Criteria:** Age ≥18, PCR confirmed SARS-CoV-2 infection or known contact of a confirmed case with PCR pending, requiring mechanical ventilation
- **Exclusion Criteria:** AST or ALT >5x ULN, eGFR<30 or on dialysis, pregnancy, multi-organ failure, requiring vasopressor support

### Situational (alphabetical order): Efficacy unproven and toxicity risk noteworthy; closely monitor for safety. ID consultation required.

» Hydroxychloroquine¹⁻⁴,¹¹,¹²⁻²⁷
- **Dosing:** 400mg PO BID x2 doses, then 200mg PO BID. Preferentially give with food.
- **Duration:** 5-10 days. Up to 20 total days of therapy have been reported in manuscripts.
- **Adverse Effects:** Generally mild/moderate severity - GI intolerances, cytopenias, QT prolongation, headaches, dizziness
- **Notes:** Potent in vitro inhibitor of SARS-CoV-2, but with multiple inconclusive, uncontrolled, or non-peer-reviewed early clinical reports. Being investigated for all stages of disease severity; use for prophylaxis appropriate only within a registered clinical trial. Use with caution in pediatrics. Impact of immunosuppressive effects is unknown. Has been studied in combination with azithromycin, without additive benefit but potential for additive cardiac toxicities (see below). Use for COVID-19 may exacerbate current shortages for patients with well-accepted autoimmune indications.

» Lopinavir/ritonavir¹³⁻¹⁴,¹⁸
- **Dosing:** 400/100mg (2 tabs) PO BID
- **Duration:** 5-10 days. Up to 14 total days of therapy have been reported, but many patients have adverse effects requiring early termination.
- **Adverse Effects:** Occur in most patients and can be moderate/severe – GI intolerances, hepatitis, and LFT abnormalities
- **Notes:** Multiple in vitro studies suggesting activity. Early clinical reports are inconclusive; one randomized trial with LPV/r initiated late in the disease course in moderately-ill hospitalized patients did not demonstrate benefit. Being investigated in further clinical trials. Many clinically significant drug-drug interactions. Adverse effects are common.
Not Recommended (alphabetical order): Risk/benefit ratio does not favor use

» Angiotensin/RAS Blocking Agents (ACEi/ARBs)\(^{17}\)
  - Do not discontinue these therapies for COVID-19 disease. Multiple professional societies in cardiology and nephrology have reviewed the current data and conclude that the evidence suggesting discontinuation of ACEi/ARB therapy to decrease risk for more severe COVID-19 is not well supported at this time.

» Azithromycin\(^{24,26}\)
  - No activity for SARS-CoV-2. Studies of combination therapy with hydroxychloroquine does not convincingly suggest added benefit with azithromycin combination therapy, given multiple study limitations and concern for antibiotic overuse.

» Darunavir/cobicistat\(^{10}\)
  - No \textit{in vitro} or clinical data yet exist to support this use, though a clinical trial has been registered in China.

» Ibuprofen/NSAIDs\(^{22-23}\)
  - Do not discontinue these therapies for COVID-19 disease. Acetaminophen is the preferred fever reducer for use in COVID-19. Although there has been theoretical concern raised for NSAIDs worsening outcomes, no data currently exist to support this. WHO has clarified their early statements and issued a clarification consistent with the above recommendation.

» Inhaled Pulmonary Vasodilators\(^{19-21}\)
  - Limited \textit{in vitro} evidence nitric oxide may inhibit coronaviruses. However, SCCM guidelines recommend against use of nitric oxide given an unfavorable risk/benefit ratio for ARDS; this agent is being investigated in clinical trials. Other agents in this group are only recommended in the presence of clinical factors where they would routinely be considered for critical care.

» Interferons\(^{8-9}\)
  - Typically used in combination with ribavirin, interferons have been studied for patients with other coronaviruses, with mixed results. Their adverse effect profiles are also generally unfavorable.

» Nitazoxanide\(^{11-12}\)
  - Some \textit{in vitro} studies have demonstrated potency against SARS-CoV-2, though clinical use against other coronaviruses has not demonstrated benefit. Poorly tolerated formulation; safety profile is relatively benign.

» Oseltamivir
  - Coronaviruses do not utilize neuraminidase for the budding stage of reproduction and therefore no activity is expected.

» Ribavirin (oral)\(^{7-9}\)
  - Typically used in combination with an interferon, ribavirin has been studied for patients with other coronaviruses, with mixed results. Additionally, its adverse effect profile can be significant (anemia), particularly at the dosages for which it has been tested for MERS (~800-3600mg/day).

» Steroids\(^{5,6,19}\)
  - CDC, WHO, and SCCM do not recommend steroid therapy for COVID-19 outside of a specific alternative indication, such as sepsis, ARDS, or COPD. Systematic reviews in other coronavirus and respiratory viral infections have demonstrated no survival benefit and possible harm.

» Tocilizumab\(^{15-16,28}\)
  - IL-6 inhibitor; IV formulation. Prior \textit{in vitro} work in SARS indicated IL-6-mediated immune hyper-response as a potential cause of poor outcomes. Preliminary clinical experience from China in COVID-19 reported benefit, however neutropenia can be long-lasting so risk of secondary infection is possible and unquantified. Both tocilizumab and the related IL-6 inhibitor sarilumab are being investigated in clinical trials.

References


4) Hydroxychloroquine clinical trials (NCT04261517, NCT04315896, NCT04318015, NCT04308668, NCT04307693). \url{https://clinicaltrials.gov/}.


10) Darunavir/cobicistat clinical trial (NCT04252274).  

https://www.nature.com/articles/s41422-020-0282-0.


http://jamanetwork.com/journals/jama/fullarticle/2762688.


17) WHO Twitter clarification on ibuprofen.  
https://twitter.com/WHO/status/1240409217997189128.


https://www.medrxiv.org/content/10.1101/2020.03.22.20040758v1.

20) Tocilizumab clinical trials (NCT04315480 and NCT04306705):  
https://clinicaltrials.gov/ct2/show/NCT04315480;  

Prepared and Reviewed by:  
Bryan Alexander, PharmD  
Trevor Van Schooneveld, MD  
Erica Stohs, MD  
Jasmine Marcelin, MD  
Scott Bergman, PharmD  
Richard Hankins, MD