Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Practice Points

Utilizing labour and delivery units for remdesivir infusion for high-risk pregnant and postpartum patients with mild-to-moderate disease during a COVID-19 surge

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In January 2022, as the Omicron variant of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) surged globally [1], multiple outpatient therapies showed a reduction in hospitalization rates when administered to patients with mild-to-moderate coronavirus disease 2019 (COVID-19), and were recommended for treatment of high-risk individuals by the National Institutes of Health and the Infectious Diseases Society of America. These therapies included monoclonal antibody treatment (sotrovimab) and antiviral treatment with molnupiravir, nirmatrelvir-ritonavir or remdesivir [2].

Pregnant individuals with COVID-19 are known to be at increased risk for severe disease, hospitalization, intensive care unit admission, and death [3]. As such, it is particularly important to manage mild-to-moderate COVID-19 in pregnant patients, and to prevent disease progression if possible. However, none of the clinical trials of outpatient medications included pregnant women. Even if they were considered candidates, severe medication shortages meant that as health systems prioritized the highest risk patients for available treatments, pregnant and postpartum patients fell below the risk threshold to receive these scarce medications.

While remdesivir was widely available during this time, the need for intravenous administration of three consecutive doses posed significant logistical challenges, given constrained infusion beds and nursing staff across the institution.

Given the experience administering remdesivir to pregnant inpatients during earlier waves of the SARS-CoV-2 pandemic [4]; the desire to offer treatment to pregnant patients at risk for disease progression; and the availability of space, nurses and pharmacy staff on the labour and delivery unit, we piloted the use of a labour and delivery unit (L&D) as an infusion centre for administration of remdesivir to high-risk pregnant patients with COVID-19.

A protocol was created to administer a 3-day outpatient course of remdesivir to high-risk pregnant and postpartum patients with mild-to-moderate COVID-19 in L&D triage. Patients admitted to L&D for labour and noted to have mild-to-moderate COVID-19 were offered inpatient treatment.

Patients were considered eligible for treatment if they met all of the following criteria: positive COVID-19 test on antigen or polymerase chain reaction testing; mild-to-moderate COVID-19 symptoms $\leq$7 days from onset; pregnant or postpartum ($\leq$4 weeks); and at least one additional risk factor [unvaccinated or under-vaccinated (partial primary course or absence of booster dose); body mass index $\geq$35 kg/m^2; diabetes on medication; severe cardiovascular disease; severe immunosuppression; chronic kidney, liver or lung disease; or sickle cell disease].

Outpatients were treated in L&D triage, and inpatients were treated in L&D. There were two outpatient appointments available daily. No pre-infusion labs were drawn unless the patient had known underlying liver or kidney disease (if

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Table I
Characteristics and outcomes of patients treated using a protocol to administer remdesivir (RDV) on a labour and delivery unit

Patient	Age (years)	Race	Ethnicity	Language	Gestational age[a]	Insurance status	Vaccination status	Additional comorbidity present	No. of RDV doses received	Days since symptom onset	Symptoms at initiation of RDV	Treated as inpatient or outpatient?	Progression to severe COVID-19?	Neonatal outcomes[b]
1	33	White	Non-Hispanic	English	PP day 8	Public	Moderna x2	None	3	0	Nasal congestion	Inpatient	No	-
2	21	Other	Hispanic	Spanish	27w6d	Public	Unvaccinated	None	3	1	Nasal congestion, sore throat	2 inpatient, 1 outpatient	No	Term (40w4d); 4.235 kg; 8/9
3	28	Black or African American	Non-Hispanic	English	33w3d	Private	Unvaccinated	BMI $\geq$35 kg/m^2, diabetes on medication	3	3	Cough, sore throat, nasal congestion, muscle aches	Inpatient	No	Preterm (35w6d); 3.375 kg; 9/9
4	23	Asian	Non-Hispanic	English	9w0d	Public	Pfizer x2	BMI $\geq$35 kg/m^2	3	5	Cough, shortness of breath, malaise	Outpatient	No	Not yet delivered; U/S at 33w5d with EFW 2.438 kg (58th percentile)
5	30	Other	Hispanic	Spanish	PP day 2	Public	Pfizer x1	BMI $\geq$35 kg/m^2	3	3	Cough	Inpatient	No	-
6	38	White	Non-Hispanic	English	27w6d	Private	Pfizer x3	Immuno-suppressed (infliximab)	3	3	Nasal congestion, fatigue, cough	Outpatient	No	Term (37w0d); 3.155 kg; 8/8
7	25	Other	Hispanic	English	38w0d	Public	Moderna x1	BMI $\geq$35 kg/m^2	3	5	Cough, sore throat, body aches, nasal congestion, SOB	Outpatient	No	Term (39w1d); 2.935 kg; 8/9
8	36	Black or African American	Non-Hispanic	English	PP day 1	Public	Pfizer x2	BMI $\geq$35 kg/m^2	1	2	Malaise, fatigue, muscle aches, fever, sore throat, cough	Inpatient	No	-

PP, postpartum; BMI, body mass index; U/S, ultrasound; EFW, estimated fetal weight; SOB, shortness of breath; COVID-19, coronavirus disease 2019.
[a] At time of first dose of RDV.
[b] Gestational age at delivery; birth weight; Apgar scores at 1 and 5 min.

indicated, complete metabolic panel and prothrombin time/international normalization ratio). Vital signs including temperature, blood pressure, heart rate, respiratory rate and oxygen saturation were monitored. Fetal assessment was conducted based on gestational age (GA). If GA <24 weeks, fetal heart rate was assessed by Doppler. If 24—28 weeks, fetal movement was assessed. If there was regular fetal movement, fetal heart rate was monitored by Doppler; in the absence of regular fetal movement, cardiotocography was performed. If GA >28 weeks, the fetus was monitored with cardiotocography.

Infusions were given as 200 mg on Day 1, and 100 mg on Days 2 and 3. Infusion time was 30 min. There was no monitoring post-infusion. If the patient did not return for the second dose, a second dose was given on Day 3 and treatment was considered complete; there was no extension beyond three consecutive days.

In total, eight patients were treated under this protocol. Table I shows a summary of patient characteristics and outcomes. Seven patients received all three doses of remdesivir, and one patient only received one dose. No patients progressed to severe disease. No maternal or neonatal adverse events occurred.

Obstetric units are uniquely positioned to offer remdesivir to pregnant and postpartum patients with mild-to-moderate COVID-19. This protocol demonstrates a feasible approach for the treatment of high-risk pregnant patients when other outpatient medical management options are either in limited supply (nirmatrelvir-ritonavir, sotrovimab) or safety concerns exist for use in pregnancy (molnupiravir).

As new variants of SARS-CoV-2 continue to emerge, options for therapy and expected efficacy vary. The BA.1 and BA.2 Omicron variants have been shown to be notably less susceptible to monoclonal antibody therapies that were effective against earlier variants [5]. In addition, while the availability of nirmatrelvir-ritonavir has increased since its release, it has many notable medication interactions which may render it inappropriate for some high-risk pregnant patients. While remdesivir for COVID-19 has not been studied specifically in pregnant or lactating women, and thus has uncertain efficacy and potential toxicity, observational data suggest that it is safe and well tolerated [4,6,7]. As such, remdesivir remains an important therapeutic option with a longer track record of use. Our experience demonstrates that obstetric units can be used efficiently as remdesivir infusion sites.

We conclude that obstetric units should create a protocol to offer remdesivir to pregnant patients with mild-to-moderate COVID-19. Given the safety and efficacy of remdesivir in pregnancy and the fact that pregnancy is a risk factor for progression to severe disease, hospitalization, intubation and death from COVID-19, it is critical to maximize available therapeutic options for pregnant patients.

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None declared.

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