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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REFERENCES

1. Goodnight WH, Bahtiyar O, Bennett KA, et al. Subsequent pregnancy outcomes after open maternal-fetal surgery for myelomeningocele. Am J Obstet Gynecol 2019;220:494.e1–7.
2. Chauhan SP, Magann EF, Wiggs CD, Barrilleaux PS, Martin JN Jr. Pregnancy after classic cesarean delivery. Obstet Gynecol 2002;100:946–50.
3. Landon MB, Hauth JC, Leveno KJ, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. N Engl J Med 2004;351:2581–9.
4. Sepulveda W, Cruz-Martinez R, Etchegaray A, et al. Open intrauterine repair of spina bifida aperta: historical aspects, current availability, and clinical outcomes from the Latin American Spina Bifida Consortium. Prenat Diagn 2021;41:933–41.
5. Ochsenbein-Kölble N, Brandt S, Bode P, et al. Clinical and histologic evaluation of the hysterotomy site and fetal membranes after open fetal surgery for fetal spina bifida repair. Fetal Diagn Ther 2019;45:248–55.

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A real-world assessment of tolerability and treatment outcomes of COVID-19 monoclonal antibodies administered in pregnancy

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OBJECTIVE: Monoclonal antibodies (mAb) for the treatment of COVID-19, which are available under emergency use authorization (EUA), prevent disease progression and reduce the risks of hospitalization and mortality when given early.[1] Pregnancy is associated with increased rates of severe illness, intensive care unit (ICU) admission, mechanical ventilation, preterm birth, stillbirth, and death compared with nonpregnant women of reproductive age.[2,3] Despite a paucity data on tolerability and outcomes, the American College of Obstetricians and Gynecologists and the Society of Maternal Fetal Medicine support the recommendation from the National Institutes of Health to offer mAb to pregnant individuals with mild-to-moderate COVID-19 infections. To date, there are only 2 published studies on mAb treatment outcomes during pregnancy.[4,5] The objectives of this study were to evaluate the tolerability of mAb treatment during pregnancy and to assess the subjective improvement in symptoms, admission within 30 days for COVID or non-COVID reasons, and the pregnancy outcomes.

STUDY DESIGN: A single-center retrospective observational chart review was conducted for all pregnant persons with mild-to-moderate COVID-19 treated with monoclonal antibodies (bamlanivimab, bamlanivimab/etesevimab, or casirivimab/imdevimab) at our medical center between December 2020 and October 2021. The tolerability; infusion-related reactions; and self-reported subjective improvement in symptoms 1−7 days after infusion; 30 days posttreatment admission for COVID or non-COVID reasons; and the pregnancy outcomes where available were analyzed. Patients were considered fully vaccinated if presenting 2 weeks or more following the receipt of 2 doses of an mRNA COVID vaccine or 1 dose of an adenoviral vector-based COVID-19 vaccine.

RESULTS: Of the 30 pregnant patients treated, 25 (83%) reported a subjective improvement in symptoms within 1 to 7 days after infusion (Table). Ten (33%) patients were admitted within 30 days posttreatment. Two (7%) patients with COVID-related admissions within 30 days required supplemental oxygen; neither developed severe infections. Both subsequently delivered at full term by cesarean delivery and were discharged home. Eight were admitted for non-COVID-related issues, 3 for full-term vaginal deliveries, 1 for management of urinary tract infection, 2 deliveries because of category II fetal heart rate tracing patterns prompting interventions (1 vaginal preterm, 1 cesarean full term), and 2 additional preterm deliveries because of preterm premature rupture of membranes. Only 1 patient reported an infusion reaction with mild hypotension and dizziness, which was resolved with fluids. Twenty-two (73%) patients had delivered by November 2021 with 15 vaginal and 4 cesarean full-term deliveries and 2 vaginal and 1 cesarean preterm deliveries. One preterm infant delivered because of preterm premature rupture of membrane required neonatal ICU admission. To date, all 22 mother−baby pairs remain stable without any abnormalities reported in infant growth and anatomy or postpartum COVID-related complications. Six (20%)

TABLE
Characteristics of SARS-CoV-2–positive pregnant patients treated with monoclonal antibodies, February 1, 2021 to October 31, 2021

Characteristics	Total n (%) n = 30
Age, median (IQR)	31.5 (25.3–38.5)
Race/ethnicity	
Hispanic	4 (0.13)
Non-Hispanic Black	19 (63.3)
Non-Hispanic White	6 (0.2)
Asian	1 (0.03)
Other	0 (0)
BMI (kg/m^2)	31 (26–35)
Fully vaccinated before treatment	1 (3)
High-risk comorbidities per EUA[a]	
BMI ≥25 (kg/m^2)	24 (80)
Pregnancy	30 (100)
Chronic lung disease	11 (37)
Chronic kidney disease	0 (0)
Diabetes mellitus	2 (7)
Immunocompromised disease or immunosuppressive treatment	0 (0)
Medical-related technological dependence	0 (0)
Neurodevelopmental disorders	0 (0)
Cardiovascular disease or hypertension	1 (3)
Number of EUA criteria met, median	2
Symptom duration before treatment	
Days, median (IQR)	3 (2–6)
Asymptomatic, n (%)	1 (3)
Monoclonal antibody product administered	
Bamlanivimab	9 (30)
Bamlanivimab/etesevimab	1 (3)
Casirivimab/imdevimab	20 (67)
Outcomes	
All-cause 30-d admission	10 (33)
COVID-related 30-d admission	2 (7)
Infusion reactions	1 (3)
Subjective symptom improvement	25 (83)
Delivered	22 (73)
Preterm	3 (14)
Full term	19 (86)

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TABLE
Characteristics of SARS-CoV-2–positive pregnant patients treated with monoclonal antibodies, February 1, 2021 to October 31, 2021 *(continued)*

Characteristics	Total n (%) n = 30
Cesarean	5 (23)
Vaginal	17 (77)
Remains pregnant	6 (20)
Terminated pregnancy by choice	2 (7)
Adverse pregnancy outcome	0 (0)

BMI, body mass index; *EUA*, emergency use authorization; *IQR*, interquartile range.

[a] https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html.

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remain pregnant, and 2 (7%) terminated their pregnancy by choice. No significant adverse pregnancy outcomes were reported.

CONCLUSION: Pregnancy is a risk factor for severe COVID-19 and meets EUA criteria for mAb treatment. Monoclonal antibodies are well-tolerated, effective, may benefit the fetus, and should be considered in pregnancy. This study supports the favorable safety and tolerability profile reported in earlier studies. Although 2 oral antivirals are now available, 1 is not indicated in pregnancy, and the other is affected by limited supplies. ■

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REFERENCES

1. Jenks JD, Aslam S, Horton LE, et al. Early monoclonal antibody administration can reduce both hospitalizations and mortality in high-risk outpatients with COVID-19. Clin Infect Dis 2021. [Epub ahead of print].
2. Khan DSA, Pirzada AN, Ali A, Salam RA, Das JK, Lassi ZS. The differences in clinical presentation, management, and prognosis of laboratory-confirmed COVID-19 between pregnant and non-pregnant women: a systematic review and meta-analysis. Int J Environ Res Public Health 2021;18:5613.
3. Metz TD, Clifton RG, Hughes BL, et al. Disease severity and perinatal outcomes of pregnant patients with coronavirus disease 2019 (COVID-19). Obstet Gynecol 2021;137:571–80.
4. Hirshberg JS, Cooke E, Oakes MC, Odibo AO, Raghuraman N, Kelly JC. Monoclonal antibody treatment of symptomatic COVID-19 in pregnancy: initial report. Am J Obstet Gynecol 2021;225:688–9.
5. Mayer C, VanHise K, Caskey R, Naqvi M, Burwick RM. Monoclonal antibodies Casirivimab and Imdevimab in pregnancy for coronavirus disease 2019 (COVID-19). Obstet Gynecol 2021;138:937–9.

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