Screening all pregnant women admitted to Labor and Delivery for the virus responsible for COVID-19

William S VINTZILEOS, MD[1]

Jolene MUSCAT, MD[1]

Eva HOFFMANN, MD[1]

Duc VO, MD[2]

Nicole S JOHN, MD[1]

Rosanne VERTICHIO, MSN, RN[1]

Anthony M VINTZILEOS, MD[1]

Author Affiliations

1. Department of Obstetrics and Gynecology, NYU Winthrop Hospital, NYU Langone Health, NYU Long Island School of Medicine, Mineola, New York
2. Department of Pathology, NYU Winthrop Hospital, NYU Langone Health, NYU Long Island School of Medicine, Mineola, New York

The authors report no conflicts of interest.

No source of financial support.

Corresponding author: William Vintzileos, 259 1st Street, NYU Winthrop Hospital, Department of Obstetrics and Gynecology, NYU Winthrop Hospital, Mineola, New York. Email: william.vintzileos@nyulangone.org, Telephone: 908-256-9493

Word count: 1434

Objective:

The COVID-19 pandemic sharply escalated in the United States in March and April of 2020. General medical and obstetric guidelines for managing suspected or positive COVID-19 patients mostly rely on maternal symptoms or close proximity to positive contacts to trigger testing and subsequently diagnose COVID-19.[1] However, it has become apparent that most cases of COVID-19 are the result of dissemination of the virus from asymptomatic individuals.[2] Persons who may unknowingly spread COVID-19 are often young and healthy, which fits the demographic of many obstetric patients. Since medical staff are urged to conserve limited personal protective equipment (PPE) for suspected or confirmed cases,[3] this increases the risk of COVID-19 transmission to front-line health care workers from asymptomatic carriers. Similarly, it increases the risk of COVID-19 transmission from mother to her infant or to other obstetrical patients on a shared antepartum or postpartum unit. We propose, therefore, that routine testing for COVID-19 should be performed in all obstetric patients admitted to Labor & Delivery (L&D), regardless of maternal symptomatology, allowing for appropriate triage, adequate obstetric and neonatal management, and safe patient transport within overcrowded hospitals.

At the time of this writing, COVID-19 testing is recommended only for patients with symptoms and those in close proximity to laboratory-confirmed positive patients. [4] The Society of Maternal Fetal Medicine in conjunction with the Center for Disease Control and Prevention advise not to prioritize testing of patients who are asymptomatic.[5] This may lead to unrecognized viral spread and the incorrect use of PPE.

The primary objective of this study was to determine the accuracy of maternal symptomatology in predicting the COVID-19 infection as confirmed by rapid laboratory testing. Secondary objectives were the rate of neonatal COVID-19 infection as well as the impact of routine maternal testing on the use of PPE as compared to its use based on symptom-driven testing.

Study Design:

This was a retrospective cohort study of all obstetric patients admitted to L&D from March 30 to April 12, 2020. Routine COVID-19 testing was implemented during this time period. Testing was performed for all admitted patients, regardless of indication for admission or presence of symptoms. IRB approval was obtained, as well as approval by a COVID-19 specific research committee within our institution. The study was performed at NYU Winthrop Hospital of the NYU Langone Health System; our hospital performs approximately 4,800 deliveries per year.

All women were asked about symptoms (fever, cough, shortness of breath). The presence of 1 or more of the aforementioned symptoms was used to determine if the patient was symptomatic. Sampling was performed by a resident physician or physician assistant in appropriate PPE using a nasal swab in a negative pressure room with closed doors. Each nasopharyngeal swab was collected in the GeneXPert Nasopharyngeal Sample Collection Kit for Viruses (Cepheid, Sunnyvale, CA) and transferred to the laboratory. Within the negative pressure fume hood, 30 mL of viral culture media from the collection kit was transferred into the Xpert Xpress SARS-CoV-2 cartridge (Cepheid, Sunnyvale, CA). The cartridge was

subsequently placed in Cepheid's equipment for polymerase chain reaction.[6] (Cepheid, Sunnyvale, CA). The PCR test takes approximately 45 minutes. The result was scored as "positive" or "negative." Viral testing was also performed in all neonates born to SARS-CoV-2 positive mothers. Results were used in clinical management to triage patients, guide PPE use, and oversee the appropriate maternal/neonatal cohorting of patients. The accuracy of maternal symptomatology to predict the COVID-19 infection was tested by constructing a 2x2 table and calculating sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio (sensitivity/1-specificity), and negative likelihood ratio (1-sensitivity/specificity).

Results:

A total of 161 patients underwent routine COVID-19 testing on admission to L&D. Age ranged 15 to 42 with a mean age of 31. There were 70 nulliparous women (43.4%) and 91 multiparous women (56.6%); 47.2% of women were Caucasian, 23.0% were Hispanic, 16.8% were African-American, and 13.0% were Asian/Indian.

Of the 161 patients tested, 32 (19.9%) were COVID-19 positive and of these 11 (34%) were symptomatic and 21 (66%) were asymptomatic (Table 1). The sensitivity, specificity, positive predictive value, and negative predictive value of maternal symptoms to predict COVID-19 infection were: 34.4% (11/32), 96.1% (124/129), 68.7% (11/16) and 85.5% (124/145), respectively. The positive and negative likelihood ratios were 8.8 (34.4/3.9) and 0.68 (65.6/96.1), respectively. Twenty-nine neonates of COVID-19 positive mothers were tested and they were all negative (3 results are pending at the time of this writing).

In order to assess the impact of routine COVID-19 testing on PPE use, we hypothesized that in our sample of 161 patients, 21 additional patients would have required PPE use, as compared to a policy of screening based on maternal symptoms, since these 21 patients were asymptomatic but tested positive for the virus. However, there were 5 patients who reported symptoms but tested negative for COVID-19; thus, PPE use could have been avoided in these patient encounters. The overall impact in terms of PPE use with routine COVID-19 testing, as compared to screening based only by maternal symptomatology, was an increase by 10% (16/161). Out of 32 COVID-positive mothers, none of their neonates tested positive.

Comment:

Twenty percent (32/161) of women admitted to L&D tested positive for Covid-19 infection; more importantly, almost two-thirds (66%) of COVID-19 positive women were asymptomatic. All 29 neonates from COVID-19 positive mothers were negative.

Routine testing for COVID-19 on admission to L&D resulted in an overall increase in the use of PPE in approximately 10% of the cases. This, however, focused the use of PPE on the right patient encounters.

The results of our study have several important clinical implications. This approach ensures that SARS-CoV-2 positive mothers are accurately identified and triaged. Clinicians can monitor for the development of symptoms while these patients are admitted and allocate inpatient resources appropriately (chest imaging, supplemental oxygen, infectious disease consults) if a mother's respiratory status changes secondary to COVID-19. On a system level, identifying COVID-19 positive mothers has a significant impact on rooming postpartum patients

with/near one another and in ensuring the safe transfer between hospital units. Knowing the SARS-CoV-2 status of a patient allows for the designated use of negative-pressure rooms and for the appropriate cleaning of these spaces by environmental services after a patient is transported.

Identifying SARS-CoV-2 positive obstetric patients also has important implications for neonatal care. The CDC currently recommends a shared decision-making process when it comes to possibly separating a newborn and a COVID-19 positive mother.[4] The fear of newborn separation may lead an expecting mother to minimize or even deny her symptoms. Routine SARS-CoV-2 testing would avoid these potential problems and ensure an open, evidence-based dialogue between patients and providers as they plan for the postpartum transition using a shared decision making model. Beyond the patient and hospital levels of care, identifying positive patients may have paramount effects at the population level. Women with evidence of a resolved infection may be eligible to donate their plasma to other COVID-19 patients who are critically ill or could be approached as potential volunteers in protocols involving future vaccine development.

Routine SARS-CoV-2 testing for obstetric patients would invariably require the use of more PPE. Inventory of equipment is already limited so this could pose a challenge to hospital supply systems. We are already encouraged to use PPE beyond manufacturers' designated shelf life, and routine testing may heighten this problem.[3] Increased PPE demand would lead to greater production and distribution costs.

Strengths of this study include the timely nature of our findings as the COVID-19 pandemic ensues, death tolls reach records highs, and communities adopt methods of social

distancing to flatten the disease curve. Our findings are applicable to the obstetric population which, regardless of the COVID-19 pandemic, cannot safely avoid or delay contact with hospitals compared to other patient populations since pregnancy is finite. The limited number of patients in our study is a potential weakness. Also, given that we only investigated obstetric patients, our findings may not be generalizable to other populations within the medical community. Additionally, since our study is preliminary and ongoing, we do not have any data on pregnancy outcomes. Our results are similar to those reported in a Letter to the Editor in the New England Journal of Medicine published on April 13, 2020 reporting that 13.5% of patients during a two-week time period at one institution were asymptomatic and positive for SARS-CoV-2;[7] this finding is very similar to the asymptomatic SARS-CoV-2 positive rate in our population of 13% (21/161).

Our results can be used as a guide to other L&D units in deciding whether to routinely test all admitted obstetric patients for SARS-CoV-2, the virus responsible for COVID-19.

References:

1. COVID-19 Testing. Department of Health. https://coronavirus.health.ny.gov/covid-19-testing. Published March 9, 2020. Accessed April 9, 2020.
2. Coronavirus disease 2019 (COVID-19), Situation Report 73. World Health Organization. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_2. Published April 2, 2020. Accessed April 9, 2020.

3. COVID-19: Strategies for Optimizing the Supply of PPE. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/index.html. Published April 3, 2020. Accessed April 9, 2020.
4. Coronavirus (COVID-19) and Pregnancy: What Maternal-Fetal Medicine Subspecialists Need to Know. Society for Maternal Fetal Medicine. https://s3.amazonaws.com/cdn.smfm.org/media/2267/COVID19-_updated_3-17-20_PDF.pdf. Updated March 17, 2020. Accessed April 9, 2020.
5. Interim Guidance: Healthcare Professionals 2019-nCoV. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-criteria.html. Published March 14, 2020. Accessed April 9, 2020.
6. Xpert® Xpress SARS-CoV-2 has received FDA Emergency Use Authorization. Cepheid. https://www.cepheid.com/coronavirus. Accessed April 9, 2020.
7. Sutton D, Fuchs K, D'Alton M, Goffman D. Universal screening for SARS-CoV-2 in women admitted for delivery. *New England Journal of Medicine*. 2020. Doi:10.1056/nejm2009316

Table 1. Accuracy of maternal symptoms in predicting COVID-19 infection

	Positive COVID-19	Negative COVID-19	Total
Symptomatic	11	5	16
Asymptomatic	21	124	145
Total	32	129	161

Sensitivity=11/32 (34.4%); specificity=124/129 (96.1%); positive predictive value=11/16 (68.7%); negative predictive value=124/145 (85.5%)

Positive likelihood ratio=8.8; negative likelihood ration=0.68