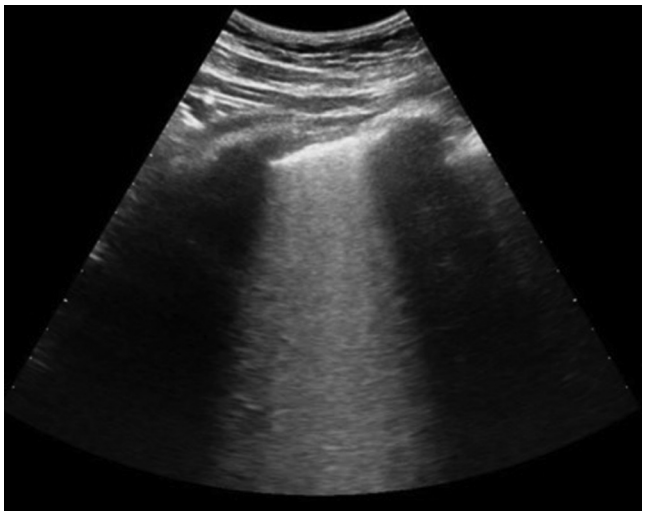
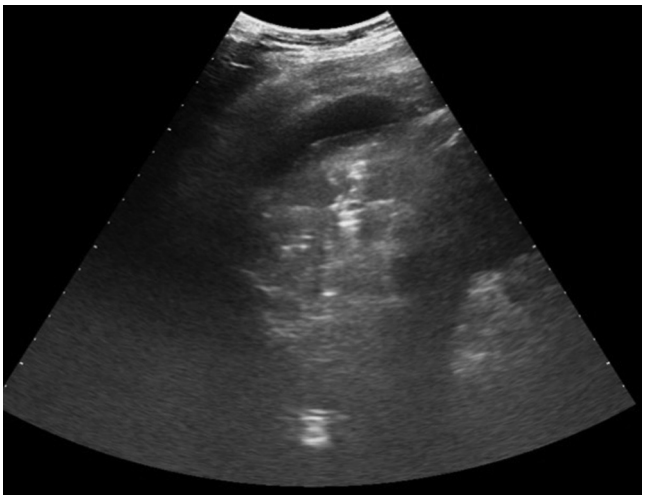
FIGURE 7
Coalescent B-lines (white lung)



Youssef. Lung ultrasound in the coronavirus disease 2019 pandemic. Am J Obstet Gynecol 2020.

FIGURE 8
Lung consolidation with air bronchogram



Youssef. Lung ultrasound in the coronavirus disease 2019 pandemic. Am J Obstet Gynecol 2020.

thinning and only some thin B-lines. The woman was discharged. She is now at 29 weeks' gestation, asymptomatic, with normally progressing pregnancy.

We believe that extensive training of physicians may be considerably helpful in case of an unfortunate but likely continuing increase in the number of COVID-19 cases. ■

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Severe acute respiratory syndrome coronavirus 2 detection in the female lower genital tract

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OBJECTIVE: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has infected more than 2 million people, caused thousands of deaths, and become a worldwide pandemic. To effectively block its transmission, all possible transmission routes must be determined. SARS-CoV-2 has been identified previously in throat and anal swabs, urine, and tears.[1] However, little has been reported about SARS-CoV-2 in the female genital tract, which may provide direct evidence on sexual and mother-to-child transmission. This study aimed to determine whether SARS-CoV-2 exists in the lower female genital tract (including vaginal fluid and cervical exfoliated cells).

TABLE
SARS-CoV-2 test by RT-PCR for vaginal fluid, cervical exfoliated cells, and anal swab samples

Patient no.	Age, y	Menopause	Days from first symptoms to sampling	Throat swab	Vaginal fluid	Cervical exfoliated cells	Anal swab
1	74	Yes	24	+	−	−	−
2	60	Yes	27	+	−	−	−
3	59	Yes	36	+	−	−	−
4	64	Yes	31	+	−	−	−
5	60	Yes	21	−	−	−	−
6	75	Yes	23	+	−	−	−
7	88	Yes	26	+	−	−	−
8	46	No	26	+	−	−	−
9	56	Yes	27	+	−	−	−
10	69	Yes	26	+	−	−	−
11	56	Yes	25	+	−	−	−
12	55	Yes	25	−	−	−	−
13	70	Yes	31	+	−	−	−
14	48	No	28	+	−	−	−
15	37	Postpartum	28	−	−	−	−
16	71	Yes	31	+	−	−	−
17	71	Yes	41	−	−	−	−
18	56	Yes	20	+	−	−	−
19	41	No	23	+	−	−	−
20	73	Yes	22	+	−	−	−
21	63	Yes	14	−	−	−	−
22	67	Yes	21	−	−	−	−
23	51	No	24	−	−	−	−
24	44	No	21	−	−	−	−
25	76	Yes	22	+	−	−	−
26	63	Yes	13	+	−	−	−
27	69	Yes	9	+	−	−	−
28	65	Yes	11	+	−	−	−
29	44	No	14	+	−	−	−
30	64	Yes	8	+	−	−	+
31	53	Yes	15	+	−	−	−
32	66	Yes	26	+	−	−	−
33	67	Yes	29	+	−	−	−
34	67	Yes	26	+	−	−	−
35	66	Yes	26	+	−	−	−

The "+" symbol stands for positive results, and "−" symbol stands for negative results.

RT-PCR, reverse transcription polymerase chain reaction; *SARS-CoV-2*, severe acute respiratory syndrome coronavirus 2.

Cui. Severe acute respiratory syndrome coronavirus 2 detection in the female lower genital tract. Am J Obstet Gynecol 2020.

STUDY DESIGN: In this study, we recruited 35 women with coronavirus disease 2019 (COVID-19) from Jan. 28, 2020, to Feb. 18, 2020, in 3 branches of the Tongji Hospital: Sino-French New City Branch (16 cases), Optical Valley Branch (16 cases), and Hankou Main Campus (3 cases). Patients received a diagnosis of COVID-19 based on the New Coronavirus Pneumonia Prevention and Control Program (5th edition) published by the National Health Commission of China (NHCC).[2] Written informed consent was obtained from each enrolled patient.

A total of 27 patients had a positive result for SARS-CoV-2 by reverse transcription polymerase chain reaction (RT-PCR) analysis on samples from the respiratory tract, which were consistent with the interim guidelines of the World Health Organization (WHO).[3] Eight patients received a clinical diagnosis of COVID-19 based on the NHCC guidelines, as mentioned previously.[2] It was a special situation in Wuhan, China, that many patients received a clinical diagnosis of COVID-19 and were admitted to COVID-19–specific hospitals based on the NHCC guidelines.[2] Patients had typical epidemiologic histories, symptoms, and computed tomography scans but lacked throat swabs with positive results. These patients were included to investigate if SARS-CoV-2 could be found in the genital tract considering that it was difficult to detect in the upper respiratory tract.

To avoid false-negative results, 3 different types of samples were obtained from each patient, including vaginal fluid, exfoliated cell, and anal swab. Each type of sample was collected twice and tested at 2 separate laboratories. Vaginal fluid samples were obtained from the posterior vagina fornix using a speculum. Swabs were rotated for 5 seconds and extracted while rotating (sampling kit from Yocon, Beijing, China). Exfoliated cell samples were collected from the cervix (or vaginal residue of patients who had undergone hysterectomy) according to the protocol of the ThinPrep cytologic test (Hologic, Marlborough, MA). The anal swab was inserted 3 cm into the anal canal and rotated for 5 seconds (sampling kit from Yocon, Beijing, China). None of the patients were admitted to the intensive care, and none had invasive ventilation; all had the ability to cooperate completely and to assume a lithotomy position, to follow the standard gynecologic examination protocol during sampling. Following the WHO guidelines for real-time RT-PCR, all samples were tested for SARS-CoV-2 using the recommended Chinese Center for Disease Control and Prevention kit (Daan Gene, Guangzhou, China, or BioPerfectus Technologies, Jiangsu, China). All the samples were processed separately and simultaneously at Tongji Hospital, Department of Clinical Laboratory, Wuhan, China, and Wuhan KDWS Biological Technology Co, Ltd, Wuhan, China. Sample collection, processing, and laboratory testing followed WHO guidelines. Positive cases were defined as patients with a positive test result from either laboratory.

RESULTS: The age range of the 35 patients was 37–88 years. Most patients were natives of Wuhan, China. More than 50% of patients had chronic diseases. The interval from the first symptoms of COVID-19 to the time of taking the samples varied between 8 and 41 days. Twenty-eight patients had entered the menopause stage. One patient was postpartum and had just undergone a cesarean delivery. As a consequence, the sampling covered women who were postpartum and postmenopausal and women of reproductive age (Table).

Results from all samples of vaginal fluid, cervical exfoliated cells, and anal swab are presented in the Table. One anal swab sample was positive for SARS-CoV-2, which is consistent with previous research, and indicated that the digestive tract was a possible transmission route.[1] All samples from the lower genital tract were negative for SARS-CoV-2. This negative result might be explained by the negative expression of angiotensin-converting enzyme 2, the receptor of SARS-CoV-2, in the vagina and cervix.[4]

We obtained breast milk from the 1 postpartum patient on the third day after delivery. A neonatologist helped to obtain neonatal throat swab samples. All the samples were negative for SARS-CoV-2, consistent with a previous study in which no SARS-CoV-2 was found in amniotic fluid, umbilical cord blood, and neonatal throat swabs.[5]

The strengths of our study include that both reproductive-age and postmenopausal women were included, multiple sites of the vagina were sampled, and all samples were double tested. Similar results were reported recently in a smaller study (n=10) in which no SARS-CoV-2 was detected in vaginal fluid.[6] Our study was limited largely by sample size. Larger studies including many young patients and the mildly or moderately ill are needed to confirm the results. Furthermore, because samples from sex partners of the patients enrolled were missing, including anal swabs, semen, and urethral orifice swabs, we could not study whether sexual activity is a mode for transmission.

CONCLUSION: SARS-CoV-2 was not found in vaginal fluid and cervical exfoliated cells. Our results showed that the lower female genital tract may not be a transmission route for SARS-CoV-2. These results may help in the selection of the method of delivery for pregnant women with SARS-CoV-2 infection. ■

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This study was reviewed and approved by the Medical Ethical Committee of Tongji Hospital of Huazhong University of Science and Technology (TJ-IRB20200208). The trial has been registered in Chinese Clinical Trial Registry (ChiCTR2000029981). Written informed consent was obtained from each enrolled patient.

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