Impact of the COVID-19 Outbreak on Routine Obstetrical Management

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ABSTRACT **Background:** Channeling medical resources for coronavirus disease-2019 (COVID-19) management can potentially endanger routine healthcare practices. As a preventive measure, a department of obstetrics and gynecology in Israel constructed a separate, designated complex for its COVID-19-exposed patients.

Objectives: To evaluate the effect of the COVID-19 pandemic infection control measures on obstetric care in the obstetrical emergency department and delivery unit.

Methods: The authors collected data retrospectively from February 2020 to March 2020 and compared it to data of a parallel period in 2019.

Results: From 1 February 2020 to 28 March 2020, 3897 women were referred to the emergency department (ED), compared to 4067 the previous year. Mean duration of treatment until decision and referral indications did not differ between 2020 and 2019 (207 vs. 220 minutes, $P = 0.26$; urgent referrals 58.8% vs. 59.2%, $P = 0.83$). A per-week comparison showed a significant reduction in ED referrals only in the last week of the period (337 [2020] vs. 515 [2019], $P < 0.001$). The proportion of women admitted to the delivery unit in active labor was significantly higher in the last three weeks (39.1% vs. 28.2%, $P = 0.005$). During February and March 2020, 1666 women delivered, compared to 1654 during February and March 2019. The proportion of types and modes of delivery did not differ. In a per-week comparison, the number of deliveries did not differ (mean 208 vs. 206, $P = 0.88$).

Conclusions: With timely preparation and proper management, negative impact of COVID-19 can be reduced in obstetrical emergency departments.

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KEY WORDS: cesarean delivery, coronavirus disease-2019 (COVID-19), emergency department, infection prevention, neonatal outcome

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Coronavirus disease-2019 (COVID-19), which is manifested by a highly contagious and infectious pneumonia, is a public health emergency of international concern [1-3]. The COVID-19 pandemic has greatly affected medical systems in countries worldwide, causing significant burden on healthcare systems, especially in countries that did not adopt strict public health outbreak response tactics such as isolation, quarantine, social distancing, and community containment [4]. Channeling medical resources for COVID-19 treatment and management can potentially endanger routine, life-saving, healthcare practice.

Obstetrics is a discipline requiring emergent management, especially in the setting of labor and delivery [5]. In Israel, hospitals are the sole place that provides obstetric services. Thus, the COVID-19 pandemic could adversely affect the treatment and management of healthy pregnant women attending maternity units.

Evidence is currently accumulating regarding the impact of the COVID-19 on infected pregnant women [6-8]. However, the impact of the COVID-19 pandemic on routine obstetrical care is still largely under-reported.

In order to provide optimal infection control without endangering the parturient population, our obstetrics and gynecology department was the first in Israel to construct a separate, geographically isolated, complex for its COVID-19-exposed patients.

We evaluated the effect of the COVID-19 pandemic infection control measures on obstetric care in the setting of the obstetrical emergency department (ED), and the short-term outcomes following hospitalization and delivery with regard to prevention measures.

PATIENTS AND METHODS

We conducted a cohort study between February and March 2020, the time period of the COVID-19 pandemic outbreak onset in Israel. The Sheba Medical Center, a tertiary, university affiliated hospital, is the largest hospital in the Middle East. Our department serves large, heavily populated urban and rural areas, and treats a heterogeneous population with over 10,000 deliveries per year.

We collected data from the obstetrical emergency department, hospitalization records, and delivery units.

We compared the 2-month period in 2020, the pandemic period, to a parallel period in 2019. We subsequently divided the periods into 8 weeks, which we compared week vs. week.

We collected the following data from the ED: number of ED referrals, referral indications, time duration spent in ED, discharge rate, delivery unit admission rate, and hospitalization rate. Deliv-

Table 1. Characteristics of deliveries and neonates from February to March for the years 2019 and 2020

Characteristics	2019	2020	*P* value
Deliveries, n	1654	1666	
Women			
Age (year)	32 ± 5.5	32 ± 5.2	0.96
Previous cesarean (%)	278 (16.8)	255 (15.3)	0.23
Multiple pregnancy (%)	142 (8.6)	118 (7.1)	0.10
Gestational age at delivery			
Gestational age, weeks§	40 1/7 ± 2 2/7	40 2/7 ± 2 2/7	0.26
Delivery < 34 weeks (%)	52 (3.1)	53 (3.2)	0.95
Delivery < 37 weeks (%)	189 (11.4)	177 (10.6)	0.46
Delivery > 41 weeks (%)	142 (8.6)	146 (8.8)	0.85
Intrapartum characteristics			
Intrapartum fever (%)	55 (3.3)	46 (2.8)	0.34
Spontaneous onset of labor (%)	715 (32.2)	684 (41.1)	0.20
Second stage of labor, minutes (%)	76 ± 77.1	80 ± 111.2	0.42
Mode of delivery			
Cesarean delivery (%)	463 (28.0)	491 (29.5)	0.33
Intrapartum cesarean delivery (%)	118 (7.1)	114 (6.8)	0.26
Operative vaginal delivery (%)	108 (6.5)	124 (7.5)	0.25
Neonatal outcome			
Birthweight, grams	3,117 ± 598	3,138 ± 604	0.30
Composite adverse neonatal outcome (%)*	117 (7.1)	96 (5.8)	0.12

Continuous variables are expressed as means ± standard deviation. Categorical variables are presented as n (%)
*A composite neonatal adverse outcome consisted of any of the following: stillbirth, neonatal death during the first 24 hours, mechanical ventilation during the first 24 hours, asphyxia, 5-minute Apgar score < 7, pH arterial cord blood < 7.0, neonatal intensive care unit admission
§Superscript refers to days/days (i.e., 2/7 means two days out of seven)

ery unit data collected included the number of deliveries, maternal characteristics (age and obstetrical history), pregnancy and delivery characteristics (number of fetuses, gestational age at delivery, intrapartum fever, mode of the onset of labor, length of the second stage of labor, and mode of delivery), and neonatal outcome (birth weight and a composite of adverse neonatal outcome).

Intrapartum fever was defined as body temperature of 38°C or higher, measured orally or rectally [9]. The composite neonatal adverse outcome consisted of any of the following: stillbirth, neonatal death during the first 24 hours, mechanical ventilation during the first 24 hours, asphyxia, 5-minute Apgar score < 7, pH arterial cord blood < 7.0, and neonatal intensive care unit admission.

STATISTICAL ANALYSIS

Patient characteristics are described as proportions for categorical variables and as means and standard deviations for continuous variables. Significance between groups was assessed by the Chi-square test and Fisher's exact test for categorical variables, and the Mann-Whitney U test, a non-parametric test for continuous variables without a normal distribution. A 2-sided *P* value < 0.05 indicated statistical significance. Statistical analyses were performed using IBM Statistical Package for the Social Sciences statistics software, version 24 (SPSS, IBM Corp, Armonk, NY, USA).

ETHICS APPROVAL

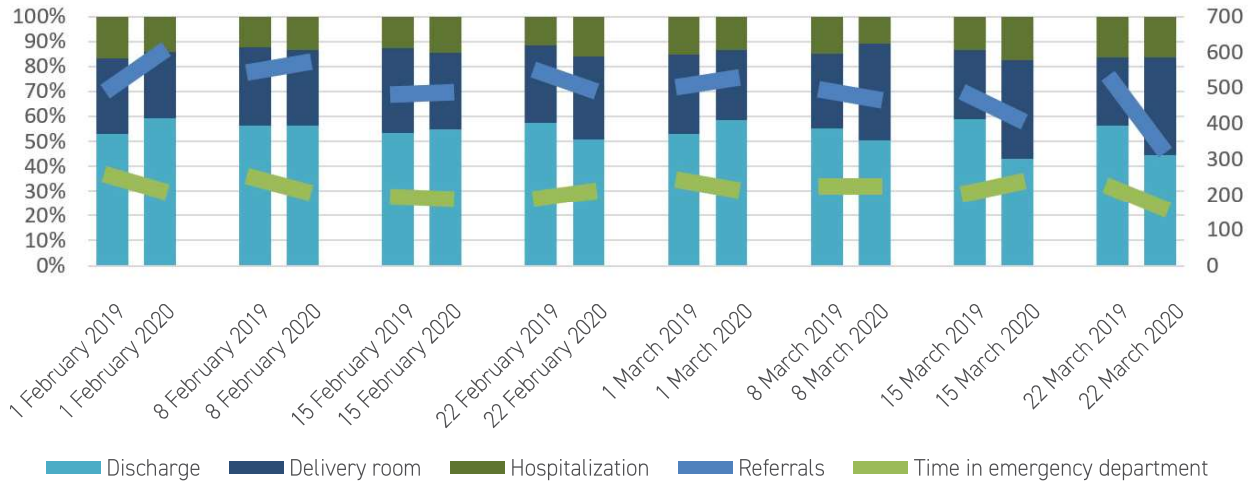
Institutional review board approval was obtained for this study (7068-20-SMC, 03/30/2020).

RESULTS

EMERGENCY DEPARTMENT

From February to March 2020, 3897 women were referred to the ED, compared to 4067 women in the previous year [Table 1, Figure 1]. The mean duration of treatment until decision and referral indications did not differ between 2020 and 2019 (207 vs. 220 minutes, $P = 0.26$; urgent referrals: 58.8% vs. 59.2%, $P = 0.83$). The per-week comparison showed a significant reduction in ED referrals only in the last week of the period [337 (2020) vs. 515 (2019), $P < 0.001$] [Figure 1]. The proportion of women admitted to the delivery unit in active labor was significantly

Figure 1. Obstetric emergency department referrals



ED = emergency department

The columns represent the 100% percent of women attending the emergency department. The three colors in the columns represent the relative proportion of the next referral- hospitalization, delivery room or discharge. The "referrals" (light blue) and "time in ED" lines represent the absolute number of cases in each week described in 2019, and the trend when compared to the parallel period in 2020

Table 2. Characteristics of deliveries and neonates in February and March 2020, compared to February and March 2020, stratified by weeks

Characteristic	1 February 2019	1 February 2020	P value	8 February 2019	8 February 2020	*P* value
Deliveries, n	211	222	NS	252	225	NS
Spontaneous onset of labor (%)	44.5	42.8	NS	43.7	42.7	NS
Intrapartum fever (%)	6.6	5.4	NS	3.2	2.2	NS
Second stage of labor, minutes	79	68	NS	69	84	NS
Delivery < 34 weeks (%)	1.9	0.9	NS	4.0	4.0	NS
Delivery < 37 weeks (%)	14.2	9.9	NS	12.7	13.8	NS
Delivery > 41 weeks (%)	7.1	11.3	NS	10.3	8.4	NS
NVD (%)	64.5	59	NS	63.1	67.1	NS
OVD (%)	8.0	7.7	NS	7.9	7.1	NS
CD (%)	27.5	33.3	NS	29.0	25.8	NS
Birth weight (g)	3093	3174	NS	3105	3086	NS
Composite neonatal* (%)	6.6	3.6	NS	6.7	8.0	NS

higher in the last three weeks (39.1% vs. 28.2%, $P = 0.005$), and the rate of discharge was inversely correlated (45.8% vs. 56.7%, $P = 0.01$).

DELIVERY UNIT

In February and March 2020, 1666 women delivered, compared to 1654 in February and March 2019 [Table 1]. The proportions of spontaneous onset of labor, trials of labor, preterm delivery, post full-term deliveries, operative vaginal delivery, and cesarean deliveries did not differ between the periods. The duration of the second stage of labor did not differ either. A trend was observed toward a lower rate of composite adverse neonatal outcomes in 2020 compared to 2019 (5.8% vs. 7.1%, $P = 0.08$). In the per-week comparison, the number of deliveries did not differ between the periods (mean 208 vs. 206, $P = 0.88$) [Table 2].

DISCUSSION

In this study of the current COVID-19 pandemic versus the parallel period in the previous year, we report a similar rate of ED re-

Characteristic	15 February 2019	15 February 2020	P value	22 February 2019	22 February 2020	*P* value
Deliveries, n	174	207	NS	223	209	NS
Spontaneous onset of labor (%)	43.7	36.7	NS	52.5	40.7	0.01
Intrapartum fever (%)	5.7	1.4	0.02	1.8	1.4	NS
Second stage of labor, minutes	64	68	NS	66	102	NS
Delivery < 34 weeks (%)	3.4	2.4	NS	3.1	3.3	NS
Delivery < 37 weeks (%)	12.6	8.7	NS	13.9	8.6	NS
Delivery > 41 weeks (%)	6.3	7.2	NS	8.5	7.2	NS
NVD (%)	70.1	59.4	NS	69.5	60.7	NS
OVD (%)	2.3	9.7	0.02	7.6	5.3	NS
CD (%)	27.6	30.9	NS	22.9	34.0	0.01
Birth weight (g)	3074	3130	NS	3122	3145	NS
Composite neonatal* (%)	10.3	4.8	0.04	6.3	7.7	NS

Characteristic	1 March 2019	1 March 2020	P value	8 March 2019	8 March 2020	*P* value
Deliveries, n	217	192	NS	192	211	NS
Spontaneous onset of labor (%)	41.5	39.6	NS	41.1	48.3	NS
Intrapartum fever (%)	3.2	3.6	NS	1.6	1.4	NS
Second stage of labor, minutes	75	83	NS	87	73	NS
Delivery < 34 weeks (%)	4.6	3.1	NS	2.6	4.3	NS
Delivery < 37 weeks (%)	10.1	11.5	NS	8.3	8.5	NS
Delivery > 41 weeks (%)	9.7	7.8	NS	7.8	10.4	NS
NVD (%)	68.2	63	NS	63	71.6	NS
OVD (%)	5.5	4.7	NS	5.7	5.2	NS
CD (%)	26.3	32.3	NS	31.3	23.2	NS
Birth weight (g)	3100	3140	NS	3151	3174	NS
Composite neonatal* (%)	8.3	5.2	NS	6.8	5.2	NS

Characteristic	15 March 2019	15 March 2020	P value	22 March 2019	22 March 2020	*P* value
Deliveries, n	194	222	NS	191	178	NS
Spontaneous onset of labor (%)	36.6	36.0	NS	40.8	41.6	NS
Intrapartum fever (%)	2.6	4.5	NS	2.1	1.7	NS
Second stage of labor, minutes	92	83	NS	75	81	NS
Delivery < 34 weeks (%)	2.1	2.3	NS	3.1	5.6	NS
Delivery < 37 weeks (%)	9.8	9.9	NS	8.9	14.6	NS
Delivery > 41 weeks (%)	6.2	9.5	NS	12.0	7.9	NS
NVD (%)	65	59.9	NS	60.7	64.1	NS
OVD (%)	5.6	10.4	NS	8.4	9.5	NS
CD (%)	29.4	29.7	NS	30.9	26.4	NS
Birth weight (g)	3113	3140	NS	3179	3113	NS
Composite neonatal* (%)	5.2	5.9	NS	6.8	5.6	NS

CD = cesarean delivery, NS = non significant, NVD = normal vaginal delivery, OVD = operative vaginal delivery
A composite neonatal adverse outcome consisted of any of the following: stillbirth, neonatal death during the first 24 hours, mechanical ventilation during the first 24 hours, asphyxia, 5-minute Apgar score < 7, pH arterial cord blood < 7.0, neonatal intensive care unit admission

ferrals and deliveries, and similar delivery and perinatal outcomes.

Pregnant women traditionally deliver in hospitals. During pandemics, an important area of concern is the implementation of infection control practices in delivery units, with emphasis on the best practices to keep healthy pregnant and postpartum women and newborns from being exposed to infected individuals [10].

Patients' fear of seeking hospital-based care may be an important determinant of hospital services utilization during a pandemic outbreak [11]. Thus, a hospital's level of preparedness for pandemics may play a central role in a woman's decision to attend it.

The first COVID-19 confirmed infection in Israel occurred on 27 February 2020. However, Sheba Medical Center was the first Israeli hospital to construct a specifically designated, geographically isolated complex for COVID-19-exposed patients, more than 2 weeks prior to the first confirmed infection. On 20 February, the first Israelis exposed to COVID-19 were hospitalized in this complex. Subsequently, our department was the first department of obstetrics and gynecology in Israel to construct a separate, designated complex for its COVID-19-exposed patients. This complex was constructed to provide all obstetrical and gynecological treatment and management facilities, including a fully equipped ED, delivery unit, operating rooms, and hospitalizations rooms. Women suspected with COVID-19 infection were first identified at a triage ward at the department's entrance. These women were subsequently referred to the designated complex for further treatment. The measures undertaken in our hospital, aimed at providing optimal isolation and separation of healthy population and COVID-19 suspected individuals, were widely reported over television broadcasts in Israel.

Our results, indicating similar ED number of referrals between 2020 and 2019, suggest that the measures taken to provide isolation accessibility at our hospital reassured the parturient population to attend it, despite increasing restrictions on mobility imposed by the government.

The World Health Organization advised parents to consider reducing prenatal clinic visits to a minimum during the pandemic influenza A [12]. Turrentine et al. described a drive-through prenatal care model to reduce the number of in-person prenatal visits during the COVID-19 outbreak [13].

Current data regarding hospital referrals rate during the COVID-19 from other medical centers are still lacking. However, a study on the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) outbreak has found a significant decrease in the number of hospital admission rate during this period [11]. This contrasts our results, but evidently does not represent exactly the same population.

We did observe a decrease in the number of referrals in the final week of the study period, probably due to further enforcement of lockdown. This finding corresponds with the observation that a higher proportion of women were admitted to the delivery unit and a lower proportion of women were discharged home in the final weeks of the period, and to the decreased time spent in the ED during the final week of the period.

We did not observe a significant difference in delivery or neonatal outcomes between the 2020 and 2019 periods, nor on a week-per-week stratification. This is an important point to underline, as burnout and exhaustion of obstetrical staff imposed by physical strain of personal protection equipment, physical isolation and long shift hours might impact medical staff and result in decreased relational skills, an impairment of empathic skills and a negative or hasty approach [14,15]. However, the radical shift in working practice characteristics during the outbreak did not result in a difference in obstetrical outcome.

Following professional recommendations and guidelines to reduce elective and ambulatory antenatal care to a minimum [15,16] during the study period in 2020, the hospital's ambulatory activity was reduced, and medical staff was allocated to provide care for urgent cases. Nevertheless, as our results demonstrate, we have managed to keep our obstetrical care in routine standard.

LIMITATIONS

First, our study's comparison to retrospective data from the previous year may increase the risk of bias inherent to such investigations. Second, we could not obtain data of referral rates from other medical centers in our area, limiting our ability to infer conclusions from our number of ED referrals. Third, the limited period of time evaluated in our study might under represent the actual impact of the current outbreak on obstetrical care in our center.

The main strength of our study is the relatively large cohort of patients and deliveries in a short period. Second, the meticulous data collection and the stratification of the period to weeks allowed optimization of our study results.

CONCLUSIONS

With timely preparation and proper management, negative impact of the COVID-19 outbreak on obstetrical emergency departments and delivery units can be reduced. Our results can aid in better decision management in the current and future infection outbreaks.

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Capsule

Proteomics of SARS-CoV-2-infected host cells reveals therapy targets

Bojkova and co-authors identified the host cell pathways that are modulated by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and showed that inhibition of these pathways prevents viral replication in human cells. The authors established a human cell-culture model for infection with a clinical isolate of SARS-CoV-2. Using this cell-culture system, they determined the infection profile of SARS-CoV-2 by translatome and proteome proteomics at different times after infection. These analyses revealed that SARS-CoV-2 reshapes central cellular pathways such as translation, splicing, carbon metabolism, protein homeostasis (proteostasis) and nucleic acid metabolism. Small-molecule inhibitors that target these pathways prevented viral replication in cells. These results reveal the cellular infection profile of SARS-CoV-2 and have enabled the identification of drugs that inhibit viral replication. The authors anticipate that the results will guide efforts to understand the molecular mechanisms that underlie the modulation of host cells after infection with SARS-CoV-2. Furthermore, the findings provide insights for the development of therapies for the treatment of COVID-19.

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Eitan Israeli

Capsule

Global prospects for COVID-19 control

Lower income countries have recognized the potential impact of coronavirus disease-2019 (COVID-19) from observing ongoing epidemics. Many have intervened quickly and early with measures to slow viral transmission, which may partly explain the low rates observed so far in these countries. **Walker** et al. calibrated a global model with country-specific data. Despite the potentially protective effects of younger demographics, the closer intergenerational contact, limitations on health care facilities, and frequency of co-morbidities in lower income countries require sustained non-pharmaceutical interventions (NPIs) to avoid overwhelming healthcare capacity. As a result of strict NPIs, the protective effects of immunity will be reduced, and it will be important to improve testing capacity. Ensuring equitable provision of oxygen and—when they are ready—pharmaceutical interventions should be a global priority.

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