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Impact of COVID-19 infection on pregnancy outcome among sample of Iraqi women

Dr. Hiyam Jasim Mohammed[1*], Dr. Asmaa Ali Lafta [2], Dr. Awatif Jaffar Sadik [3]

1- M.B.Ch.B., F.I.C.O.G, MRCOG1; Specialist in Obstetrics & Gynecology at Al-Karkh Maternity hospital-Baghdad
2- M.B.Ch.B., F.I.B.O.G, CABOG, DOG, MRCOG1; Specialist in Obstetrics & Gynecology at Al-Karkh Maternity hospital-Baghdad
3- M.B.Ch.B., EBCOG; European Board & College of Obstetrics & Gynecology; Specialist in Obstetrics & Gynecology at Al-Karkh Maternity hospital-Baghdad

***Corresponding Author ,** Contact email: hiyamjassim@gmail.com*

Original Article

ABSTRACT

Background: *COVID-19 pandemic disease had great impact on health status in Iraq. The pregnant women and their infants might be at higher risk after infection by COVID-19 disease.*

Aim of study: *To evaluate the maternal and neonatal characteristics of pregnant women infected by COVID-19 disease and assessing the maternal and neonatal outcomes in Iraqi from a sample of pregnant women.*

Patients & Methods*: A clinical prospective follow up study carried out in Obstetrical wards and Labour room at Al-Karkh Maternity Hospital in Baghdad city-Iraq. The duration of the study was six months through the period from 1st of July to 31st December, 2020. A convenient sample of 132 pregnant women at labour was selected after eligibility to inclusion and exclusion criteria. The pregnant women enrolled in the study were tested by COVID-19-Reverse transcription polymerase chain reaction test at their admission to hospital.*

Results*: The present study showed that 63.6% of pregnant women at labour room had positive COVID-19 infection, while only 6 (4.5%) fetuses had positive COVID-19 infection after delivery. There was a highly significant association between first cesarean section of pregnant women and positive COVID-19 infection (p<0.001). A significant association was observed between preterm labour of fetuses and positive maternal COVID-19 infection (p=0.01). There was a significant association between meconium aspiration of fetuses and positive maternal COVID-19 infection (p=0.001).*

Conclusions: *The incidence of maternal and fetal COVID-19 infection among sample of Iraqi pregnant women delivered in hospital is relatively high and accompanied with maternal and fetal morbidities.*

Keywords: *COVID-19, Pregnancy, Maternal outcome, Fetal outcome.*

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1. INTRODUCTION

Since declaration of coronavirus disease 19 (COVID-19) as pandemic by World Health Organization (WHO), great worry was directed toward pregnant women and their fetuses [1]. The COVID-19 infection caused severe acute respiratory syndrome clinically presented by fever, cough and fatigue [2] and radiologically presented with ground glass opacities [3] and may be accompanied by 3-15% mortality rates [4]. The first reported pregnant women infected by COVID-19 was in China at 2019,[5] that followed by many cases developed severe form of the disease [6] and confirmed later the risk of maternal-fetal vertical transmission of severe COVID-19 infection [7]. The pregnant women might be at higher risk to be infected by COVID-19 diseases due to physiological changes of pregnancy like changes in immunological, respiratory and vascular systems, that lead to variable response to the disease 2 and also the infants might be at higher risk through their development [8].

The physiological changes in immune system of pregnant women like shifting in CD+T cells, lowering levels of natural killer cells, higher progesterone levels and changes in innate immune system lead to alteration of response of pregnant women to COVID-19 infection [9]. The anatomical and physiological pregnancy changes of respiratory system such as diaphragm changes lead to reducing of lung volume and lowering the functional residual capacity that aggravating the COVID-19 disease [10]. Hypercoagulation, intravascular inflammation with increase of thrombin levels during pregnancy might make pregnant women at higher risk of thromboembolism and higher mortality if infected with COVID-19 disease [11-13]. Additionally, the changes in endothelial cells function during pregnancy also play role in altering response to viral infections [14]. Physiologically, the placenta acts as barrier preventing transmission of maternal infections to fetuses,[15] however, it was shown that COVID-19 viruses was infecting the placenta leading to placental damage [16, 17]. The vertical transmission and placental infection is not always lead to fetal infection with COVID-19 virus [18-20]. For that, and also due to passage of maternal immunoglobulin through placenta, lower neonatal cases were reported [21]. Moreover, severe acute respiratory diseases of neonate are rare [22].

In poor countries, the maternal care system is already disrupted and the effect of pandemic infection crises might increase the maternal morbidity and mortality rates[23]. Many adverse maternal outcomes were reported throughout COVID-19 pandemic like lack of antenatal care, partner violence, anemia, miscarriage, in addition to death risk associated with COVID-19 infection [24, 25]. Recent data from United Kingdom reported higher risk of COVID-19

infection on pregnant women with higher susceptibility to poor outcomes [26]. Although minor adverse neonatal outcomes of COVID-19 disease were reported,[5, 27, 28] preterm birth risk was detected for pregnant women infected by COVID-19 disease [19]. Many authors documented that maternal infection by severe acute respiratory syndrome coronavirus (SARS) or Middle East respiratory syndrome (MERS) become severe and accompanied with many neonatal morbid condition like prematurity, miscarriage and fetal growth restriction [5, 29, 30].

The first reported case infected with COVID-19 in Iraq was at February 24th, 2020. At first 6 months of pandemic outbreak, low incidence rates of COVID-19 were recorded among Iraqi population due to different reasons specifically strict and national wide social distancing and closing borders [31]. Nowadays, the infected Iraqi cases reached to the number of one million infected cases with COVID-19 disease and thousands of deaths [32]. The health system in Iraq is suffering from multiple risks such as damaged infrastructure, low number of health facilities, workforce migration, inaccessibility to accurate information and social care, internal displacement, sanction and wars which all lead to higher maternal and neonatal morbidity and mortality rates [33]. Consequently, the COVID-19 outbreak and increased number of infected pregnant women recently has a great burden on national maternal and neonatal health care program which might lead to poor outcomes of pregnancy infected by COVID-19 disease. Despite the great impact of COVID-19 disease on pregnancy, there was a scarcity of national researches discussing this important issue that might be related to limited resources and low number of available national trained medical staff free for applying researches during crises. For all of above rationale, this study was conducted to evaluate the maternal and neonatal characteristics of pregnant women infected by COVID-19 disease and assessing the maternal and neonatal outcomes in Iraqi from a sample of pregnant women.

2. PATIENTS and METHODS

The design of current study was a clinical prospective follow up study carried out in Obstetrical wards and Labour room at Al-Karkh Maternity Hospital in Baghdad city-Iraq. The duration of the study was six months through the period from 1st of July to 31st December, 2020. The study population was all pregnant women presented to Obstetrical wards and Labour room for labour. Adult age (age ≥18 years), pregnancy, at gestational age of 28 weeks and more with signs of labour were the inclusion criteria. The exclusion criteria were younger age pregnant women, second trimester, history of confirmed

COVID-19 infection in last 6 months, co-morbidity with medical diseases (such as diabetes mellitus, hypertension and cardiovascular disease), history of obstetrical diseases (such as preeclampsia, recurrent miscarriages and antepartum hemorrhage), intrauterine growth retardation, congenital anomalies and women refused to participate. A convenient sample of 132 pregnant women at labour was selected after eligibility to inclusion and exclusion criteria. Data were collected by the researcher from selected pregnant women directly and fulfilling a prepared questionnaire. The questionnaire was designed by the researchers depending on previous literatures. The questionnaire included the followings: general characteristics (age and gravidity), maternal and fetal COVID-19 PCR tests findings, maternal outcomes of pregnant women (delivery mode, cesarean section umber and maternal status) and fetal outcomes of pregnant women (gestational age, fetal status, fetal gender, intrauterine death and meconium aspiration). The pregnant women enrolled in the study were tested by COVID-19-Reverse transcription polymerase chain reaction (RT-PCR) test at their admission to hospital. Each pregnant women included in this study was examined by the researchers after taking full history and some of them referred to Radiology for chest x-ray to assess extent of lung involvement. The confirmation of COVID-19 diagnosis was done according to the Iraqi guidelines assessed by Iraqi Ministry of Health. The treatment protocol of patients was designed according to Iraqi Guidelines in management. The patients were followed up from their admission to the discharge. The improvement was reported according to the patient's condition and laboratory findings. Deteriorated or not improved COVID-19 cases are characterized by severe symptoms of acute respiratory distress syndrome, low oxygenation, neutophilia and lymphopenia, very high CRP, elevated D-dimer and sometimes on extent of lung involvement by x-ray. Death or alive final outcome was finally reported. The neonates were admitted to neonatal intensive care unit after labour and also examined by RT-PCR test for infection by COVID-19 and assessed by Pediatrician. Data were analyzed with the Statistical Package of Social Sciences (SPSS) software version 22. Chi square and Fischer's exact tests applied when suitable. Level of significance (p.value) of ≤ 0.05 considered statistically significant.

3. RESULTS

This study included 132 pregnant women with mean age of (24.6 years) and range of 20-43 years; 72% of pregnant women were in age group 20-29 years, 25% of pregnant women were in age group 30-39 years and 3% of pregnant women were in age group of 40 years and more. Primigravidity was represented by 17.4% of pregnant women, while multigravidity was represented by 82.6% of them, (**Table 1**). Delivery mode of studied pregnant women was normal vaginal delivery for 54.5% of pregnant women and cesarean section for 45.5% of pregnant women. The cesarean section was the first for 46.7% of pregnant women, or 2nd-4th for 35% of pregnant women or 5th and more 18.3% of pregnant women delivered by cesarean section. The death was recorded only for one pregnant woman, while 99.2% of pregnant women were alive, (**Table 2**).The gestational age of fetuses was preterm among 17.4% of pregnant women, while term gestational age was recorded for 82.6% of pregnant women. Fetal death was detected among 5 (3.8%) fetuses, while alive fetal status was detected among 96.2% of pregnant women. Male fetuses represented 40.2%, while female fetuses represented 59.8% of them. The fetal intrauterine death was shown in 2.3% of pregnant women, while meconium aspiration was shown in 13.6% of pregnant women fetuses, (**Table 3**). The maternal COVID-19 PCR test showed that 63.6% of pregnant women at labour room had positive COVID-19 infection, while 36.4% of them were free from COVID-19 infection. The fetal COVID-19 PCR test showed that only 6 (4.5%) fetuses had positive COVID-19 infection after delivery, while 95.5% of fetuses had no COVID-19 infection after delivery, (**Table 4**).

No significant differences were observed between pregnant women with positive COVID-19 infection and pregnant women with negative COVID-19 infection regarding age of women ($p=0.1$) and gravidity history ($p=0.2$), (**Table 5**). No significant differences were observed between pregnant women with positive COVID-19 infection and pregnant women with negative COVID-19 infection regarding delivery mode ($p=0.1$) and maternal status ($p=0.2$). There was a highly significant association between first cesarean section of pregnant women and positive COVID-19 infection ($p<0.001$), (**Table 6**). A significant association was observed between preterm labour of fetuses and positive maternal COVID-19 infection ($p=0.01$). No significant differences were observed between pregnant women with positive COVID-19 infection and pregnant women with negative COVID-19 infection regarding fetal status ($p=0.08$), although 5 fetuses of pregnant women with positive COVID-19 infection were died, while no death reported among fetuses of women

with negative COVID-19 infection. No significant differences were also observed between pregnant women with positive COVID-19 infection and pregnant women with negative COVID-19 infection regarding fetal gender (p=0.1) and intrauterine death (p=0.1). There was a significant association between meconium aspiration of fetuses and positive maternal COVID-19 infection (p=0.001), (**Table 7**).

Table 1: General characteristics of pregnant women.

Variable	**No.**	**%**
Age mean± SD (24.6±5.6 years)		
20-29 years	95	72.0
30-39 years	33	25.0
≥40 years	4	3.0
Gravidity		
Primigravida	23	17.4
Multigravida	109	82.6
Total	**132**	**100.0**

Table 2: Maternal outcomes of pregnant women.

Variable	**No.**	**%**
Delivery mode		
Normal vaginal	72	54.5
Cesarean section	60	45.5
Cesarean section number		
First	28	46.7
2^{nd}-4^{th}	21	35.0
5^{th} and more	11	18.3
Maternal status		
Alive	131	99.2
Dead	1	0.8
Total	**100**	**100.0**

Table 3: Fetal outcomes of pregnant women.

Variable	No.	%
Gestational age		
Preterm	23	17.4
Term	109	82.6
Fetal status		
Alive	127	96.2
Dead	5	3.8
Fetal gender		
Male	53	40.2
Female	79	59.8
Intrauterine death		
Yes	3	2.3
No	129	97.7
Meconium aspiration		
Yes	18	13.6
No	114	86.4
Total	**132**	**100.0**

Table 4: Maternal and fetal COVID-19 PCR tests findings.

Variable	No.	%
Maternal COVID-19 PCR		
Positive	84	63.6
Negative	48	36.4
Fetal COVID-19 PCR		
Positive	6	4.5
Negative	126	95.5
Total	**132**	**100.0**

Table 5: Distribution of pregnant women general characteristics according to maternal COVID-19 PCR test findings.

Variable	Maternal COVID-19 PCR				*P*
	Positive		Negative		
	No.	%	No.	%	
Age					
20-29 years	62	73.8	33	68.8	0.1 NS
30-39 years	18	21.4	15	31.3	
≥40 years	4	4.8	0	-	
Gravidity					
Primigravida	17	20.2	6	12.5	0.2 NS
Multigravida	67	79.8	42	87.5	

S=Significant, NS=Not significant.

Table 6: Distribution of maternal outcomes according to maternal COVID-19 PCR test findings.

Variable	Maternal COVID-19 PCR				*P*
	Positive		Negative		
	No.	%	No.	%	
Delivery mode					
NVD	42	50.0	30	62.5	0.100 NS
Cesarean section	42	50.0	18	37.5	
Cesarean section number					
First	28	66.7	0	-	**<0.001** S
2^{nd}-4^{th}	12	28.6	9	50.0	
5^{th} and more	2	4.7	9	50.0	
Maternal status					
Alive	83	98.8	48	100.0	0.4 NS
Dead	1	1.2	0	-	

NVD: Normal vaginal delivery S=Significant, NS=Not significant.

Table 7: Distribution of fetal outcomes according to maternal COVID-19PCR test findings.

Variable	Maternal COVID-19 PCR				*P*
	Positive		Negative		
	No.	%	No.	%	
Gestational age					
Preterm	20	23.8	3	6.3	**0.01** S
Term	64	76.2	45	93.8	
Fetal status					
Alive	79	94.0	48	100.0	0.08 NS
Dead	5	6.0	0	-	
Fetal gender					
Male	38	45.2	15	31.3	0.1 NS
Female	46	54.8	33	68.8	
Intrauterine death					
Yes	3	3.6	0	-	0.1 NS
No	81	96.4	48	100.0	
Meconium aspiration					
Yes	18	21.4	0	-	**0.001** S
No	66	78.6	48	100.0	

S=Significant, NS=Not significant.

4. DISCUSSION

The COVID-19 disease in pregnancy represents a great challenge to obstetricians as the pregnant women are more prone for infection and risk of vertical transmission to fetuses leading to adverse outcomes for both mother and neonates in addition to risk of COVID-19 disease progression to severe acute respiratory disease which facing the challenge of mechanical ventilation of pregnant women 34.

Current study showed that that 63.6% of pregnant women at labour room had positive COVID-19 infection and only 6 (4.5%) fetuses for positive COVID-19 women had positive COVID-19 infection. These rates are higher than results of Woods et al 35 in USA on tested 415 pregnant women and tested 71 fetuses in urban hospital which revealed that 9.9% of pregnant women by PCR had positive COVID-19 infection and 2.8% of fetuses had positive COVID-19 infection. Our study rates are also higher than results of Knight et al 26 prospective national population based study in UK on 427 pregnant women admitted to hospital which found that incidence rate of positive COVID-19 among pregnant women was (4.9 per 1000 women) and incidence of COVID-19 disease among infants was (5%). These differences might be attributed to many reasons such as differences in health infrastructure and epidemiology of COVID-

19 disease between different countries in addition to differences in study design and sample size between literatures and fact that our study center is tertiary center receiving referrals of difficult obstetrical cases from different obstetrical centers. In present study, no significant differences were observed between infected pregnant women and non-infected pregnant women regarding age of women and gravidity history. These findings are inconsistent with results of Zambrano et al 36 study in USA and Du et al 37 study in China which documented that maternal age of more than 35 years and gravidity history play role in COVID-19 infection and severity among pregnant women. Present study showed a highly significant association between first cesarean section of pregnant women and positive COVID-19 infection ($p<0.001$). This finding coincides with results of Brandt et al d9 study in USA and Ashokka et al 38 study in Chile which reported higher rates of cesarean section delivery among pregnant women especially first cesarean section. Cai et al 39 stated that it is wrong to adopt the cesarean section as routine delivery mode for pregnant women infected by COVID-19 disease and they proved that maternal and neonatal outcomes of pregnant women delivered by normal vaginal delivery were lower than that of infected pregnant women delivered by cesarean section. Our study showed no significant differences were observed between infected pregnant women and non-infected pregnant women regarding delivery mode. This finding is inconsistent with results of Pirjani et al 40 study in Iran which reported to higher rates of cesarean sections among pregnant women with positive COVID-19 infection. Only one studied infected pregnant woman in present study (1.2%) was died. This finding is lower than results of Sharief et al 41 study in Iraq which documented death of 7 (5.18%) pregnant women after infecting by COVID-19 disease. This difference may be due better obstetrical and medical resuscitation facilities in our tertiary center. However our study maternal mortality rate is close to results of Karimi et al 42 study in Iran which reported maternal mortality rate of (1.3%) of infected pregnant women with COVID-19.

In current study, a significant association was observed between preterm labour of fetuses and positive maternal COVID-19 infection ($p=0.01$). This finding is similar to results of many literatures such as Al-Kuraishy et al 43 study in Iraq, Akthar et al 44 study in UK and Yang et al 45 study in USA which found higher risk of preterm birth for infants of infected pregnant women by COVID-19 disease. It was shown that SARS and MERS infections are also regarded as risk factors for preterm birth and other

adverse outcomes 29. The preterm birth might be due to placental disruption caused by COVID-19 infection and the hypoxia resulted from the infection17. Our study showed also a significant association between meconium aspiration of fetuses and positive maternal COVID-19 infection (p=0.001). This finding coincides with reports of AbdelMassih et al 46 systematic review study in Egypt which stated that infants born for infected pregnant women by COVID-19 disease are at high risk of meconium aspiration. Higher rates of neonatal meconium aspiration might be related to higher rates of first cesarean section among infected pregnant women 47. Our study showed that 5 (6%) fetuses of pregnant women with positive COVID-19 infection were died, while three intrauterine fetuses death (3.6%) was recorded. These rates are higher than results of Simsek et al 48 study in Turkey which revealed neonatal mortality rate of (1.2%) for infected pregnant women with COVID-19 disease.

In conclusion, the incidence of maternal and fetal COVID-19 infection among sample of Iraqi pregnant women delivered in hospital is high. The main adverse maternal outcome of infected pregnant women is first cesarean section with relatively acceptable maternal and fetal mortality rates. The common adverse fetal outcomes for infected pregnant women are preterm labour and meconium aspiration. This study recommended social distancing for pregnant women with precautions and preventive measures that should be undertaken by pregnant women and more efforts from health institutes to encourage regular antenatal care.

5. CONCLUSIONS

The incidence of maternal and fetal COVID-19 infection among sample of Iraqi pregnant women delivered in hospital is relatively high and accompanied with maternal and fetal morbidities.

Ethical Clearance

All ethical issues and data collection were in accordance with the World Medical Association Declaration of Helsinki 2013 for ethical issues of researches involving humans. Ethical approval obtained from Ethical Committee at Iraqi Ministry of Health. Informed verbal consent was taken from all pregnant women. Data and privacy of patients were kept confidentially and continuous management and care for infected pregnant women were approved.

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