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Original Research Article

Prevalence of meconium-stained amniotic fluid in SARS COVID-19 positive pregnant mothers and its manifestations in newborns

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ABSTRACT

Background: This study is being conducted to find out whether coronavirus disease 2019 (COVID-19) is associated with an increased incidence of MSAF in COVID-positive pregnant women. Finding implications for operative delivery and perinatal outcome. The evidence will help in managing COVID-positive women in pregnancy.
Methods: This prospective observational study was conducted from July 1, 2020 to October 20, 2020 at Rajarajeswari Medical College and Hospital, Bangalore. A total 38 newborns born to SARS-COVID-19 infected mothers were included. Data collected from pregnant women, patient records, birth registries, operating room/delivery room records and NICU registries.
Results: The clinical characteristics of 38 mothers and their newborns were analyzed. The mode of delivery was normal vaginal delivery (NVD) in most (N=21) cases. All newborns tested negative for SARS-CoV-2. 18 babies required only routine newborn care, and 20 babies required neonatal intensive care unit (NICU) admission at birth for management of meconium-stained amniotic fluid (MSAF)(11pregnancies), prematurity (3 cases), dyspnea (6 cases), stage 2/3 hypoxic ischemic encephalopathy (HIE) (2 cases), and Jaundice (9 cases). 18 of 38 stable babies held mother's side and breastfeeding started, with no signs and symptoms attributed to SARS-CoV-2.
Conclusions: In our study, the prevalence of MSAF is higher (28%) in COVID-19 Positive mothers, resulting in low APGAR scores and poor perinatal outcomes. Vigilant intrapartum care is recommended to reduce the risk of poor neonatal outcomes. No newborns developed signs and symptoms of SARS-CoV-2 infection during rooming-in, breastfeeding and during admissions at neonatal intensive care unit (NICU).

Keywords: MSAF, SARS-COVID-19, Newborn, NICU

INTRODUCTION

On the eve of 2020, the first report received by WHO of coronavirus positive was found in Wuhan, Hubei Province, China. In the next few months, widespread transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), was reported in many countries around the world. WHO (World Health Organization) designated the disease as novel coronavirus disease (COVID-19) and later, on March 11, 2020, WHO announced corona virus as global pandemic.[1] As of 27 February 2023, 44.68 million people were affected, of which over 44.15 million people have recovered and around 0.53 million deaths have been noted in India. According to various studies, all age groups including newborns and the elderly are at risk, but there are some groups that are more susceptible to infection, One such group are pregnant women.[2] Although the current literature on COVID-19 continues to inform our

perspectives on disease progression, its pregnancy-specific implications remain undetermined.

The risk of increased complications such as preterm labor (12.9%), small for gestation (SGA) and fetal distress, MSAF, asphyxia at birth in COVID-positive pregnant women, contributing to poor neonatal outcome.[5,6] Changes during pregnancy such as reduced functional residual volume, diaphragmatic elevation, airway mucosal edema, and changes in cellular immunity can lead to increased susceptibility to viral infections and worsen outcomes for both mother and child.[7]

Meconium is normally a dark green liquid within 24-48 hours of life that is excreted by the newborn which contains mucous, gall and epithelial cells. In some cases, however, the meconium is excreted in-utero stains the amniotic fluid. This can vary from slight to severe discoloration. It is considered significant if it is dark green or black and has a thick, tenacious appearance. Contents of meconium are particularly the bile salts and enzymes, can cause serious complications if inhaled by the fetus at any stage of labor. This can lead to meconium aspiration syndrome (MAS). There are several pathologic mechanisms involved in MAS, including prenatal infection/inflammation and activation of the inflammatory cascade, mechanical airway obstruction, surfactant inactivation, and persistent pulmonary hypertension.

Meconium passage is usually observed as one of the consequences of fetal hypoxia.[8-10] Meconium aspiration syndrome (MAS) secondary to MSAF is a major cause of neonatal mortality. Many studies showed that MSAF is associated with a high risk of fetal distress, operative deliveries, and an increased incidence of perinatal morbidity and mortality (23.63%), babies born with respiratory distress (10.5%), moderate to severe hypoxic ischemic encephalopathy (HIE stage 2 or more) (3.6%) and sepsis (7%).[11] An increased risk of low birth weight (14.3%), and intrauterine growth restriction (IUGR) is also common.[5,12] Maternal pyrexia secondary to COVID-19 and associated viremia during labor may lead to increased cases of MSAF. resulting in higher rates of operative intervention and perinatal morbidity and mortality. The current study is being conducted to find out if COVID-19 is associated with an increased frequency of MSAF in COVID-positive pregnant women. Detection of MSAF has implications for operative delivery, cesarean rates, and perinatal outcome. Studies on MSAF and perinatal outcomes in COVID-positive mothers are lacking. The evidence generated by this study is helping to advise the COVID-positive mothers and guides on the management of COVID-positive women in labor according to the State Government in April 2020.

The aim of the present study was to determine the prevalence of MSAF in pregnant women hospitalized with laboratory-confirmed SARS-CoV-2 infection. Baby safety during breastfeeding and rooming-in was also assessed.

METHODS

Study design

This prospective observational study was conducted from July 1, 2020 to October 20, 2020 at COVID Hospital, Rajarajeswari Medical College and Hospital, Bangalore, Karnataka State. All babies (n=38) born to SARS-COVID-19 infected mothers were included in the study, written informed consent was obtained from the parents of the newborn. The study was approved by the institutional ethics committee

Inclusion and exclusion criteria

SARS-COVID-19 positive mothers in spontaneous labor was included in the study. COVID negative pregnancy babies with refusal of consent were excluded for the study.

Case définition

COVID-positive pregnant women with a positive throat swab report on a real-time polymerase chain reaction (RT-PCR) COVID-19 detection kit as recommended by the Indian council for medical research (ICMR), both symptomatic and asymptomatic, were included. A mother was considered positive if she delivered either within 10 days of SARS-COVID-19 positivity or if the delivery occurs 10 days after her positive result, but she is still not negative on repeat RT -PCR- test.

Procedure

All infants born to a mother with SARS-CoV-2 infection were included in the study during the study period of approximately 3 months. Data were collected from patients' medical records and birth register, which were matched to OP records and NICU registers. The required data was collected in a pre-designed data entry form, including demographic information such as pregnant mothers' age, gestational age, maternal clinical characteristics, risk factors associated with pregnancy such as preterm onset of labor, premature rupture of membranes, gestational diabetes, hypertension in pregnancy, meconium-stained liquor, Delivery mode, birth weight, and neonatal outcome (APGAR score, type of resuscitation, MAS, and need for hospitalization) recorded. All stable neonates were shifted to mother side for routine newborns care, and newborns with complications at birth like meconium-stained amniotic fluid (MSAF), prematurity, dyspnea, stage 2 or 3 hypoxic ischemic encephalopathy (HIE) and hyperbilirubinemia were kept in the NICU for further management.

Most newborns required routine care at birth and were transferred to the mother's side for rooming-in unless the mother was unwilling to keep the baby or was critical unwell and therefore could not take care of the baby. Infants placed in a room were allowed to breastfeed with appropriate droplet and contact precautions.[4] All newborns

were tested for SARS COVID-19 infection by nasopharyngeal (NP) swab collection within 36 hours of life. No visitors other than medical staff wearing appropriate personal protective equipment were allowed to enter the COVID neonatal unit. Newborns admitted to the NICU were given expressed breast milk as soon as it became available. SARS COVID-19 negative newborns held at the mother's side in the postpartum ward were not retested and the babies were discharged once hemodynamically stable and after 10 days on Direct breastfeed or full Palladian feeds along with the mothers, babies received breastfed as per ICMR guidelines if asymptomatic. Babies were followed up by telephone every week up to 4 weeks to check their well-being.

Sample size

There are several methods used to calculate the sample size depending on the type of data or study design.The sample size is calculated using the following formula

$$n = \frac{2(Za + Z1 - b)2a2b}{delta2}$$

Where n is the required sample size. For Za, Z is the constant (set by convention according to the accepted a error and whether it is one –sided or two sided effect).

Data analysis

Data on demographic, epidemiological, and clinical characteristics were collected from case files. Data were analyzed with Statistical Package for Social Science version (SPSS) 16.0 for windows software. Qualitative variables (all categorical variables) were expressed as frequency and percentage (N, %). Quantitative variables were prescribed in terms of mean±standard deviation.

RESULTS

In our study, the majority of births were by normal vaginal delivery (N=21) and male babies were 16 (42%) and female babies were 22 (57.8%). The mean birth weight for newborns was 2.71(±0.45), with 31 newborns being of gestational age-appropriate weight (AGA) and 7 low weights for gestational age (SGA) newborns, 35 babies had good crying at birth with an excellent APGAR score (7-10) at 1 minute, 2 babies were severely depressed with an APGAR score (0-3) of 2 at 1 minute, 1 baby with a moderately depressed APGAR (4-6) at birth. At 5 minutes, APGAR was excellent (7-10) in 36 neonates, 1 moderately depressed (4-6) and 1 severely depressed (0-3).

The mean length of hospital stay for all newborns was 6.50 (±2.99). 18 out of 38 newborns were shifted to mother side for routine care and rooming in after birth, 2 babies required admission to neonatal intensive care unit (NICU) for therapeutic hypothermia for hypoxic ischemic encephalopathy (HIE) stage 2-3. 11 of 38 newborns were born through meconium-stained liquor and in which 2 babies had associated MAS with moderately depressed APGAR scores requiring Oxygen support and 1 baby requiring tactile stimulation to initiate breathing at birth. 4 babies required supplemental oxygen in the first 24 hours due to mild to moderate respiratory distress at birth, 1 baby received IV antibiotics because the mother had premature rupture of membranes (PROM) for more than 24 hours at presentation. 1 newborn received nevirapine prophylaxis at birth due to maternal retro-positivity (HIV positive). All 38 newborns tested negative for SARS COVID-19 RT-PCR on a throat swab taken at 36 hours of life. 37 newborns discharged from hospital along with mothers after completion of treatment in NICU or routine care in Post natal ward, 1 newborn discharged alone as mother died from complications related to SARS-Covid-19 infection.

Table 1: Sociodemographic features of pregnant women in study (n=38).

Parameters		N	%
Age (years)	Mean age	23.95(±3.26)	
Reproductive age group	≤19	2	5.2
	20-24	23	60.5
	25-29	11	28.9
	30-34	2	5.2
Gestational age		38.42(±1.081)	
Preterm (<37 weeks)		3	7.9
Term (37-42 weeks)		30	78.9
Post term (42 weeks)		5	13.2
Mode of delivery	Vaginal	21	55.3
	Caesarean section	17	44.7
Clinical features of COVID-19 infection	Asymptomatic	35	92.1
	Symptomatic	3	7.9
Risk factors associated			
PROM (Premature Rupture of Membrane)		2	5.2
Meconium-stained liquor		11	28.9
Oxygen received for COVID-19		3	7.8
Mortality		1	2.6

Table 2: Dmographic details of newborns.

Parameters		N	%
Gender of newborn	Male	16	42.1
	Female	22	57.9
Whether baby was isolated from the mother?	Yes	20	100

Continued.

Parameters		N	%
Baby had any symptoms	No	18	
	Breathing difficulty (RDS)	5	
	HIE	2	
Birth weight (kg)		2.71 (±0.45)	
AGA (2.5-4)		31	81.6
SGA (<2.5)		7	18.4
APGAR score at 1 minute	Severely depressed (0-4)	2	-
	Moderately depressed	1	-
	Excellent	35	-
APGAR score at 5 minutes	Severely depressed	1	-
	Moderately depressed	1	-
	Excellent	36	-
Duration of hospital stay		6.50(±2.99)	-
Baby COVID status	Positive	0	-
	Negative	38	100
Outcome	Baby and mother discharged	37	97.4
	Baby discharged and mother death	1	2.6

DISCUSSION

Principal findings

The study showed that pregnant women who tested positive for COVID-19 upon presentation for delivery were often asymptomatic (asymptomatic), suggesting a protocol for universal testing for pregnant women admitted to the maternity ward. We further found that although many of these women eventually developed symptoms, the severity of disease in this small cohort of pregnant patients was mild to moderate and appeared to be similar to what is reported in the literature for nonpregnant subjects as described. The statistically insignificant results can be attributed to the small sample size, which did not provide the power needed to detect the differences.

Results in the context of what is known

Pregnant women may be more susceptible to pneumonia and other respiratory infections compared to non-pregnant women, due to physiological changes during pregnancy that include airway edema, diaphragmatic elevation, increased oxygen consumption, and pregnancy-related immune changes.[7] These physiological changes also make pregnant mothers less tolerant of hypoxia. Therefore, until we get more evidence to the contrary, there is reason to remain concerned about the clinical course of COVID-19 during pregnancy, despite encouraging early experiences here and elsewhere. Clinical implication; COVID-19 poses a major public health threat and based on current trajectories of exponential disease growth, large numbers of potentially asymptomatic COVID-19 positive pregnant women are expected to present for treatment. Our results suggest that COVID-19 is often asymptomatic and should be considered in all pregnant women in areas with high disease prevalence.

Research implications

Our study results show that the incidence of MSAF in COVID-positive pregnant mothers is increased by approximately 28% versus the background risk of approximately 10-18% in COVID-negative mothers.[8] Meconium-stained amniotic fluid (MSAF) can result from pyrexia associated with COVID-positive status or the associated viremia.[9,10] Nayak et al concluded in their study of neonatal outcomes in COVID-positive mothers that MSAF was observed in 23.63% of cases, which is comparable to the current study.[11] Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) scores correlated with meconium grades with lower scores being observed with grade III or IV MSAF, which was statistically significant. The study by Masood et al concluded that lower APGAR scores are associated with MSAF, even more so in primiparous women.[3]

Strength and limitations

In fact, unfortunately, the number of patients (sample size) was smaller than it should be. This was one of the limitations of the study. although our hospital is a tertiary medical care center in Bangalore and has a bed capacity of 1300 beds. We tried our best to collect all eligible cases with inclusion criteria during the study period of approximately 3 months. We were able to provide one of the largest case series of pregnant women with COVID-19 to date, although admittedly this series is still small. This cohort includes a relatively small number of COVID-19 patients presenting for healthcare at our nearby affiliated hospital and similar clinical practices. Having a control group in the study will increase the level of scientific evidence. However, in our study we only attempted to determine the prevalence of MASF in mothers with COVID-19 positivity and the outcome in babies born to such mothers. this is a new and vague era of the pandemic.

Therefore, we have attempted to describe the magnitude and variables associated with the problem, rather than finding associations and correlations between variables.

The limitations were; prospective observational design, does not establish a temporal association of MSAF with COVID-positive status. Both symptomatic and asymptomatic women were included in the study. Further studies are needed in this area to produce clinical guidelines for managing COVID-positive mothers. Another limitation being that we failed to exclude women with confounding risk factors for MSAF like premature labor, gestational diabetes, pregnancy induced hypertension and post term delivery,

CONCLUSION

The frequency of MSAF is increased in COVID-positive mothers, resulting in low APGAR scores and a poor perinatal outcome. Vigilant intrapartum care is recommended for these pregnancies to reduce the risk of poor neonatal outcome. Due to the small sample size, we tend to be neutral about our conclusion. There were no significant maternal or fetal complications in the majority of study participants associated with COVID-19, most likely due to strict precautions. And complications related to MSAF such as respiratory distress and hypoxia-ischemic encephalopathy were noted in 2 newborns. COVID patients must be encouraged to breastfeed early while taking all infection control precautions and reassuring mothers. Further research with a larger sample size is needed to understand the true extent of the risks and improve management. We believe that universal testing has obvious benefits for all pregnant women admitted to the unit of work, in addition to those presenting for triage evaluation of symptomatic ailments, leading to best practices to protect patients, their families and the obstetrician should contribute.

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