Impact of different waves of COVID-19 on the rate and indications of Caesarean delivery: An Observational Study

Deepika Meena, Manju Puri, Nishtha Jaiswal, Manisha Kumar, Anu Handa, Shilpi Nain

Lady Hardinge Medical College & SSKH, New Delhi

Correspondence
Dr. Deepika Meena
Dept of Obstetrics and Gynaecology
Lady Hardinge Medical College & SSKH, New Delhi -110001, India

Email: deepika18meena@gmail.com Phone: (+91) 011-24674033, (+91) 9968761401

Received: 23 March 2022
Accepted: 5 May 2022

Citation: Meena D, Puri M, Jaiswal N, Kumar M, Handa A, Nain S. Impact of different waves of COVID-19 on the rate and indications of Caesarean delivery. Nep J Obstet Gynecol. 2022;17(34):85-91. DOI: https://doi.org/10.3126/njog.v17i34.48060

ABSTRACT

Aims: To assess the impact of the COVID-19 pandemic on caesarean section rate, its indications, and related maternal and neonatal mortality rates during the first and second waves in comparison to pre-COVID era.

Methods: This is retrospective observational analytical study conducted at a tertiary hospital from Northern India. Case records of 3196 women who underwent caesarean delivery (CD) during pre-Covid, Covid first wave and covid second wave periods from April to September each year in 2019, 2020 and 2021 respectively were reviewed.

Results: Institutional delivery rate reduced by 45% and 38% during first and second waves respectively. The overall CD rate in the study groups 1 (29.34%) and 2 (30.09%) was comparable with control group (28.70%). Difference in CD rate in COVID-19 positive and negative women was comparable. The most common indication for CD was foetal distress followed by labour dystocia in all groups. Caesarean delivery for failed induction was significantly reduced in both waves. However, CD for previous two or more caesarean sections and non-reassuring FHR were significantly increased in first wave and for deranged doppler in second wave. Maternal mortality ratio and neonatal mortality rate were comparable in all groups.

Conclusions: Institutional delivery rate significantly reduced in COVID-19 pandemic with non-significant change in caesarean section rate and significant difference in few indications

Keywords: cesarean delivery, cesarean section, COVID-19, maternal mortality, neonatal mortality

INTRODUCTION

COVID-19 outbreak has brought in an unprecedented change in the global and national landscape on daily wellbeing.[1] Although prioritised as an essential core health service[2], some reports indicate the adverse impact of pandemic related restrictions on maternal and new-born health services in low- and middle-income countries resulting in reversal of hard-earned gains over the past two decades.

As world continues to grapple with the COVID-19 pandemic, countries have adopted several measures to control disease transmission, including travel restrictions, lockdowns, and dedicated facilities for COVID positive patients. Vulnerable populations including pregnant women and their new-borns were hit harder not so much due to infection by SARS COV 2 but due to disruption in essential maternal and child health services.

The impact of COVID-19 on access to health services, health outcomes and maternal mortality were difficult to gauge during ongoing pandemic; however, routine data analysis systems could be used to assess changes in health services or maternal mortality due to COVID-19 pandemic in low income and middle-income countries.[4] Our understanding of this virus is changing rapidly and so are our clinical practices. Planned surgeries and procedures were postponed during the COVID pandemic but not the childbirth. Concerns regarding prolonged exposure of the care provider to a COVID positive labouring pregnant woman, fear of contracting infection and uncertainty regarding vertical transmission of infection from mother to the new-born did contribute to an increase in caesarean section rates initially.[5,6]

The second stage of labour added extra challenges to maternity service providers caring for pregnant women during labour. The International Society for Ultrasound in Obstetrics and Gynaecology (ISUOG) has delivered quite a few information resources and have included the second stage of labour, vaginal delivery and caesarean delivery under general anaesthesia as probable aerosol generating procedure (AGP) that requires suitable PPE including N95 or respirator.[7]

The evidence as regards optimum timing and mode of delivery with respect to vertical transmission of infection to new-born is evolving. Not many studies have delved into the impact of different waves on caesarean delivery.

This study tries to answer this question based on an analysis of 3196 caesarean deliveries in pre-pandemic and pandemic times (1st and 2nd waves). Aim of this study is to assess the impact of the COVID-19 pandemic on caesarean section rate, its indications, and related maternal and neonatal mortality rates.

METHODS

This retrospective study was conducted in the department of Obstetrics and Gynecology at a tertiary level health facility in North India with an annual load of 13000 births. A total 1036 pregnant women who underwent CD between 1st April 2020 to 30th September 2020, a six-month period during first wave of COVID-19 pandemic at our hospital constituted study group 1, whereas 331 pregnant women who underwent CD between 1st April 2021 to 31st May2021, two months period during second wave of COVID-19 pandemic constituted study group 2. The control group comprised of 1829 women who underwent CD during the six months duration 1st April 2019 to 30th September 2019 in the pre-COVID times. The total number of births and caesarean sections in each of this period were recorded. After procuring Ethical clearance from the institutional ethical committee, the case records of women who underwent CD were retrieved. Maternal age, parity, gestation, indication of CD along with maternal and neonatal outcomes were collected anonymously.

The caesarean delivery rate was calculated p er 100 live births. The category of indications for CD was based on hospital protocol and

was like a previous study by Nelson et al.[8] Coded information was entered in an Excel sheet for analysis. The primary outcome was the rate of CD during three time frame of pandemic; and secondary outcomes were indications for CD, and maternal and neonatal mortality. Coded information was

entered in an Excel sheet and later analysed using SPSS software version 25. Categorical variables were represented in percentages and analysed using Chi-square test or fisher exact test. P value of less than 0.05 was considered statistically significant.

RESULTS

The hospital delivery rate reduced by approximately 45% during first wave and 38% in second wave of COVID-19 pandemic. During the six months of first wave of COVID-19 pandemic, (between 1st April 2020 to 30th September 2020) 1036 out of 3531 (29.34%) women underwent CD compared to 331 out of 1100 (30.09%) during the second wave from 1st April 2021 to 31st May2021. In the six months pre-COVID between 1st April 2019 to 30th September 2019, 1829 out of 6372 women (28.70%) underwent CD. There was no significant difference in CD rate between the study group 1 and 2 as compared to control group (p value 0.50 and 0.44). [Table-1]

Table-1: Comparison of Caesarean-delivery rate between pre-COVID and two COVID waves

Month	Pre Covid-CD			Covid 1st wave			Covid 2nd Wave		
	Total births	CD	% of CD	Total births	No. of CD	% of CD	Total births	No. of CD	% of CD
April	937	275	29.35	497	131	26.36	555	140	25.30
May	853	239	28.02	497	137	27.57	545	191	35.04
June	975	279	28.62	488	133	27.25	-	-	-
July	1227	365	29.75	597	198	33.17	-	-	-
August	1220	349	28.61	724	229	31.63	-	-	-
September	1160	322	27.76	728	208	28.57	-	-	-
Total	6372	1829	28.70	3531	1036	29.34	1100	331	30.09

In the study group 1, 206 women out of 3531 were COVID -19 positive with a CD rate of 29.12 % (60/206) and in study group 2 among 1100 women 124 were COVID-19 positive with a CD rate of 30.6% (38/124)) which was comparable to that in non-covid pregnant women 29.35% and 30% in study group 1 and 2 respectively) [Table 2].

The number of pregnant women who underwent CD due to foetal distress in the study group 1(33.88%) and study group 2 (35.04%) were not significantly higher than that in the control group (32.26%) (p value 0.37 and 0.55). However, CD for non-reassuring FHR was significantly higher in study group 1 compared to control group 23.26% vs 19.46% (p<0 .016) and CD for MSL in early labour was significantly lower 5.89% vs 9.35% (p value <0.001). However, in study group 2 CD for both non-reassuring FHR and for MSL in early labour were comparable to control group (p=0.36 and 0.64) respectively. No significant difference was observed in CD for deranged Doppler in study groups 1(4.73% vs 3.44%) but it was significantly high in study group 2 (6.94% vs 3.30%, p=0.01).

Labour dystocia was the second common indication for CD in all groups that is study groups 1 and 2 and control group with CD rate 20% (p=0.07), 18.12% (p value 0.45) and 17.33% respectively. CD for failed induction was significantly lower in both study groups 1 and 2 compared to control group 7.63% vs 11.15% and 5.13% vs 10.70% respectively (p<0.01). CD for malpresentations were also significantly lower in study group 1 compared to control group (8.01% vs 10.44%, p=0.03). Amongst malpresentations breech presentation was the commonest. Caesarean delivery for previous 2 or more CD

were higher during COVID period in study group 1 compared to non-COVID period 8.59% and 6.12% respectively (p<0.01). No significant change in CD rate was seen for indications such as placental previa, abruption and placenta accreta. No significant change in CD rate was observed for multiple pregnancies. [Table-3]

Table-2: Comparison of Caesarean Delivery rate between COVID positive cases and COVID negative cases

Month	Covid positive cases			Covid negative cases		
	Total births	No. of CD	% of CD	Total births	No. of CD	% of CD
Apr 2020	14	3	21.42	483	128	26.50
May 2020	30	9	30	467	128	27.40
Jun 2020	76	22	28.94	412	111	26.94
Jul 2020	30	10	33.33	567	188	33.15
Aug 2020	22	8	36.36	702	221	31.48
Sep 2020	34	8	23.52	694	200	28.81
Total 2020	206	60	29.12	3325	976	29.35
Apr 2021	104	28	26.92	451	112	24.83
May 2021	20	10	50	525	181	34.47
Total 2021	124	38	30.64	976	293	30
Total	330	98	29.69	4301	1269	29.5

Early neonatal mortality rate before and during COVID-19 pandemic was comparable.

In study group1 and control group it was 17.27 vs 18.04 per 1000 live births respectively (p=0.84) and in study group 2 and control group it was 28.18 vs 24.02 per 1000 live births respectively (p=0.54). Maternal mortality ratio (MMR) in CD was also similar in both groups. In study group 1 it was 141.6 vs 109.8 per 100000 live birth in control group (p value- 0.89) and in study group 2 it was 272.72 vs 194.55 per 100000 live birth in control group (p=0.15).

Table-3: Comparison of indications of Caesarean Delivery between pre covid and during covid period

Indications	2019 (Pre-covid, 6 months)		2020 (1st wave, 6 months)		p-value	2019 (Pre-covid, 2 months)		2021 (2nd wave, 2 months)		p-value
	N	%	N	%		N	%	N	%	
Fetal distress	590	32.26	351	33.88	0.37	170	33.07	116	35.04	0.55
Labour dystocia	317	17.33	208	20	.075	83	16.14	60	18.12	0.45
Failed induction	204	11.15	79	7.63	<0.01	55	10.70	17	5.13	0.005
Previous LSCS	294	16.07	163	18.63	0.06	88	17.12	49	14.80	0.39
Malpresentation	191	10.44	83	8.01	0.03	64	12.45	42	12.68	0.91
Multiple pregnancy	50	2.73	36	3.46	0.31	10	1.94	8	2.41	0.63
Placental causes	120	6.56	71	6.85	0.76	35	6.80	29	8.76	0.35
Cord Prolapse	14	0.76	4	0.38	0.32	3	0.58	6	1.81	0.16
Other causes	49	2.67		1.54	0.06	6	1.16	4	1.20	1

DISCUSSION

Overall rate of caesarean delivery has shown a substantial increase over the last decade. WHO threshold level of optimum CD rate is

approximately 19 %, beyond which there is no decrease in MMR and NMR. The spectrum varies from a very few CD being done in Low middle-income countries (4·1% in Western and Central Africa) and too many being done in high income countries like Latin America and the Caribbean where CS rate are as high as 44%.[9] In India we have a coexistence of both these ends of the spectrum.

Although the overall annual CD rate is 17.2% in India, there is a stark difference in CS rates across various parts of India (<5% to >75%).[10] The first wave of COVID pandemic lasted for six months whereas the second wave was sharp and steep and lasted for 2 months. The overall number of deliveries in our hospital decreased from 6372 in the six-month pre-COVID period to 3531 (< 45%) during the 1st wave and from 1790 in corresponding 2 months pre COVID times to 1100 (<38%) during 2nd wave of COVID. Similar reductions in institutional births of 33% were reported during the Ebola virus disease outbreak in Liberia.[11] We delivered a total of 206 COVID positive pregnant women in first wave and 124 in second wave. A decrease in institutional childbirth by more than half during lockdown, with increase in institutional stillbirth rate and neonatal mortality, and decreases in quality of care are also reported in literature.[12] However, in our study no significant change in neonatal mortality and maternal mortality in CD was seen during COVID period.

In this study, no significant change was noted in CD rate between 1st wave of COVID, 2nd wave and pre-COVID period. It was observed that the CD rates were comparable between COVID positive and COVID

negative pregnant women in both waves. This is contrary to high rates of 80% and 68.9% CD reported in literature in COVID-19 positive women is with COVID-19 status alone being a common indication.[13,14] This difference can be explained by the fact that ours was a mixed facility and provided services to both COVID positive and negative pregnant women. The COVID status of majority of the women who reported in emergency was not known. They underwent universal screening with nasopharyngeal swab for RTPCR and were managed as COVID suspects for the first 24-48 hours till the report was available.

Interestingly there was a significant difference observed as regards indications of CD in pre-pandemic and pandemic periods. In our study caesarean delivery for failed induction reduced significantly in the two waves. This was possibly due to delays in availability of operation theatre resulting in many women going in active labour during the waiting time and a change in policy of elective induction of labour at 40 weeks+ to 41 weeks+ to reduce the number of inductions and duration of hospital stay. Low risk pregnancies were continued till 41 weeks and monitored on OPD basis by AFI and NST along with daily foetal movement count as the patient load was lesser due to pandemic related lockdowns and travel restrictions. There was also a change in method of induction of labour in women with preterm premature rupture of membranes from oxytocin infusion to sublingual misoprostol. No CD was done for COVID-19 positive status alone or on maternal request. However, it is important to note that most of the COVID-19 pregnant women admitted were asymptomatic or with mild symptoms. A study reported that difference in the overall rate of CD between the two groups (before lockdown and after lockdown) was not statistically significant and among the indications, CD on maternal request (CDMR) and fetal distress were significantly more common in the study group (p<0.05) compared to the control group.[15]

The most common indication contributing to CD in previous studies had been fetal distress, labour dystocia and failed induction. Even during pandemic fetal distress remained the most common indication for CD.[16,17] Similarly, in our study most common indication for caesarean delivery was fetal distress followed by labour dystocia. CD for non-assuring FHR was significantly increased in month of June 2020 during the peak of COVID-19 cases in Delhi in the first wave. This was consequence to nonavailability of CTG machines in COVID

areas and inability of doctors to monitor COVID positive patients adequately due to donning of personal protective equipment. Fear of contracting infection also contributed to inadequate monitoring and resultant increase in CD rate due to non-reassuring FHR in the first wave.

Caesarean section for previous ≥2 CS were high during first wave as compared to non-covid period. It was maximum in the month of August 2020 possibly due to lifting of lockdown and increased referrals from other tertiary care hospitals that were converted in to COVID dedicated centres

Out come in the form of early NMR before and during COVID-19 pandemic was comparable. The still birth rate during the pandemic was higher at our centre as compared to pre pandemic period. It was not due to COVID illness per se but due to the delays in decision to seek help, reaching the hospital and receiving care at the facility.[18] MMR in CD was also comparable in all groups. A systematic review from Mumbai India of 441 pregnant women with COVID-19 from 16 countries, reported a maternal death rate of 3%, still births (1.6%) and neonatal death rate of 1%.[11]

A large sample size, unknown status of pregnant woman at admission, presence of a control group and data from both waves are the main strengths of our study. This information on COVID-19 is likely to be useful in developing a relevant action plan to address this public health issue. The limitations of this study include that it is a single centre study and received both booked and un-booked pregnant women.

CONCLUSIONS

During pandemics when most of the medical procedures can be put on hold women continue to deliver babies. In our study institutional delivery rate reduced by almost half during COVID-19 pandemic. The rate of CD, neonatal mortality rate, maternal mortality ratio in CD during 1st and 2nd wave of COVID were not significantly higher than in the pre-covid times. However statistically significant changes were observed in few indications of CS. Lower number of CD were done for failed induction of labour, breech presentation and meconium-stained liquor suggesting decrease in some unnecessary avoidable indications for CD like breech, meconium-stained liquor without any foetal heart rate changes and overdiagnosis of failed induction. The non-reassuring CTG was less due to nonavailability of CTG machines especially during the first wave.

REFERENCES

1. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun. 2020;109:102433.
2. World Health Organization. (2020). COVID-19: operational guidance for maintaining essential health services during an outbreak: interim guidance, 25 March 2020. World Health Organization. https://apps.who.int/iris/handle/10665/331561.
3. Graham WJ, Afolabi B, Benova L, Campbell OMR, Filippi V, Nakimuli A, et al. Protecting hard-won gains for mothers and newborns in low-income and middle-income countries in the face of COVID-19: call for a service safety net. BMJ Global Health. 2020;5(6):e002754. http://dx.doi.org/10.1136/bmjgh-2020-002754
4. Kc NP, Kc A, Sharma N, Malla H, Thapa N, Aryal K, et al. Community participation and mobilization in community-based maternal, newborn and child health programmes in Nepal. J Nepal Health Res Counc. 2011;9(2):101-6. PMID: 22929838.
5. Del Piccolo L, Donisi V, Raffaelli R, Garzon S, Perlini C, Rimondini M, et al. The Psychological Impact of COVID-19 on Healthcare Providers in Obstetrics: A Cross-Sectional Survey Study. Front Psychol. 2021;12:632999.

6. Alfieri N, Manodoro S, Marconi AM. COVID-19 does not stop obstetrics: what we need to change to go on safely birthing. The experience of a University Obstetrics and Gynecology Department in Milan. J Perinat Med. 2020;48(9):997-1000.
7. Palatnik A, McIntosh JJ. Protecting Labor and Delivery Personnel from COVID-19 during the Second Stage of Labor. Am J Perinatol. 2020;37(8):854-856.
8. Jonathan PN. Indications and appropriateness of caesarean sections performed in a tertiary referral centre in Uganda: a retrospective descriptive study. Pan Afro Med J. 2017;26:64.
9. Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. Lancet. 2018 Oct 13;392(10155):1341-1348. PMID: 30322584. doi: 10.1016/S0140-6736(18)31928-7
10. Molina G, Weiser TG, Lipsitz SR, et al Relationship Between Cesarean Delivery Rate and Maternal and Neonatal Mortality. JAMA. 2015;314(21):2263-70.
11. Iyengar P, Kerber K, Howe CJ, Dahn B. Services for mothers and newborns during the Ebola outbreak in Liberia: the need for improvement in emergencies. PLoS Curr. 2015;7:7.
12. Kc A, Gurung R, Kinney MV, Sunny AK, Md Moinuddin M, Basnet O, et al. Effect of the COVID-19 pandemic response on intrapartum care, stillbirth, and neonatal mortality outcomes in Nepal: a prospective observational study. Lancet Glob Health. 2020;8(10):e1273-e1281. DOI: https://doi.org/10.1016/S2214-109X(20)30345-4
13. Gajbhiye RK, Modi DN, Mahale SD. Pregnancy outcomes, newborn complications, and maternal-fetal transmission of SRAS-CoV-2 in women with COVID-19: a systematic review of 441 cases. MedRxiv. 2020; e45215732.
14. Debrabandere ML, Farabaugh DC, Giordano C. A Review on Mode of Delivery during COVID-19 between December 2019 and April 2020. Am J Perinatol. 2021;38(4):332-41.
15. Li M, Yin H, Jin Z, Zhang H, Leng B, Luo Y, et al Impact of Wuhan lockdown on the indications of cesarean delivery and newborn weights during the epidemic period of COVID-19. PLoS One. 2020;15(8):e0237420. https://doi.org/10.1371/journal.pone.0237420
16. Singh N, Pradeep Y, Jauhari S. Indications and Determinants of Cesarean Section: A Cross-Sectional Study. Int J Appl Basic Med Res. 2020;10(4):280-5.
17. Gedefaw G, Demis A, Alemnew B, et al. Prevalence, indications, and outcomes of caesarean section deliveries in Ethiopia: a systematic review and meta-analysis. Patient Saf Surg. 2020;14:11.
18. Kumar M, Puri M, Yadav R, Biswas R, Singh M, Chaudhary V, et al. Stillbirths and the COVID-19 pandemic: Looking beyond SARS-CoV-2 infection. Int J Gynaecol Obstet. 2021;153(1):76-82. Epub 2021 Jan 13. PMID: 33368201; PMCID: PMC9087794. doi: 10.1002/ijgo.13564