The Relationship of Response Time of Emergency C-Sections with Maternal and Perinatal Outcomes in the Emergency Installation of RSUP Dr Kariadi Semarang: Observations in the COVID-19 Era

ABSTRACT

BACKGROUND: Emergency caesarean section is a surgical procedure performed when there is an immediate threat to the life of the fetus and/or mother. The interval in minutes between the decision for a cesarean section by the obstetrician until the incision is carried out is called the response time. Long response times in emergency caesarean section cases have been reported to be associated with worsening maternal and perinatal outcomes. Research shows that the COVID-19 pandemic also influences the incidence of emergency caesarean section in hospitals.

AIMS: Analyzing the relationship between the response time for emergency caesarean section and the outcomes of maternal and perinatal in the emergency department of RSUP Dr. Kariadi Semarang in the era of COVID-19

METHOD: A retrospective observational analysis, cross-sectional time series study of three waves of COVID-19 involving 205 emergency cesarean section patients divided into 56 patients in wave 1, 85 patients in wave 2 and 64 patients in wave 3. The independent variable of the study was response time for emergency caesarean section. The dependent variables of the study were maternal outcomes (blood transfusion, puerperal fever, surgical site infection, hysterectomy, postpartum hemorrhage, and maternal death) and perinatal outcomes (APGAR score, need for resuscitation, prematurity and infant death). The confounding variables are the hour of the incident (hour of day), the day of the incident (day of week). The Chi-square test and Fischer Exact test were used to analyze with significant results if $p<0.05$

RESULT: There is no relationship between the response time for emergency caesarean section procedures in the emergency department during the three waves of the COVID-19 pandemic at RSUP Dr. Kariadi Semarang with the need for blood transfusion (p=1,000), maternal childbed fever (p=1,000), surgical site infection (p=1,000), hysterectomy (p=1,000), postpartum hemorrhage (p=1,000), maternal death (p =1,000), APGAR score (p=1,000), need for resuscitation (p=1,000), prematurity (p=0.487) and infant death (p=1,000).

CONCLUSION: There is no relationship between the response time for emergency caesarean section procedures in the emergency department during the three waves of the COVID-19 pandemic at RSUP Dr. Kariadi Semarang with maternal outcomes and perinatal outcomes.

Keywords: COVID-19, emergency caesarean section, response time, maternal outcomes, perinatal outcomes

1. Introduction

The outbreak of coronavirus disease 2019 (COVID-19), caused by SARS-CoV-2, first emerged in Wuhan, China, and has now spread to most regions and countries around the world.[1,2] Indonesia, as of March 16 2023, has experienced a significant threefold increase in the number of confirmed COVID-19 patients. This increase in numbers is specifically referred to as the COVID-19 Wave, which consists of the first wave (January 2021 – April 2021), the second wave (July 2021 – November 2021), and the third wave (February 2022 – May 2022).

Emergency caesarean section is a surgical procedure performed when there is an immediate threat to the life of the fetus and/or mother. The interval in minutes between the decision for a cesarean section by the obstetrician until the incision is carried out is called response time. Response time is influenced by patient and operating room preparation time, anesthesia time, and skin incision to delivery time interval. According to the Royal College of Obstetricians and Gynecologists (RCOG) and the American College of Obstetricians and Gynecologists (ACOG), the recommended response time for emergency caesarean section is within 30 minutes.[3] This is in accordance with the Ministry of Health's direction which states that PONEK Hospitals must be able to prepare emergency caesarean section operations within 30 minutes.[4]

Research conducted by Eleje GU, et al which compared the rate of cesarean sections and clinical outcomes before and during the first wave of COVID-19 found that the number of cesarean sections performed during the COVID-19 pandemic was less than before the COVID-19 pandemic (40 % vs 46.8%). However, the rates of pregnancy serotinus (OR=1.47), fetal distress (OR=3.06), emergency caesarean section (OR=1.43), and anemia (OR=1.84) were significantly higher during the COVID-19 pandemic compared to before the COVID-19 pandemic.[5] This shows that the COVID-19 pandemic has an influence on the incidence of emergency caesarean section in hospitals.

This study aims to analyze the relationship between the response time for emergency caesarean section with outcomes of mothers and babies in the emergency department of RSUP Dr. Kariadi Semarang in the era of COVID-19.

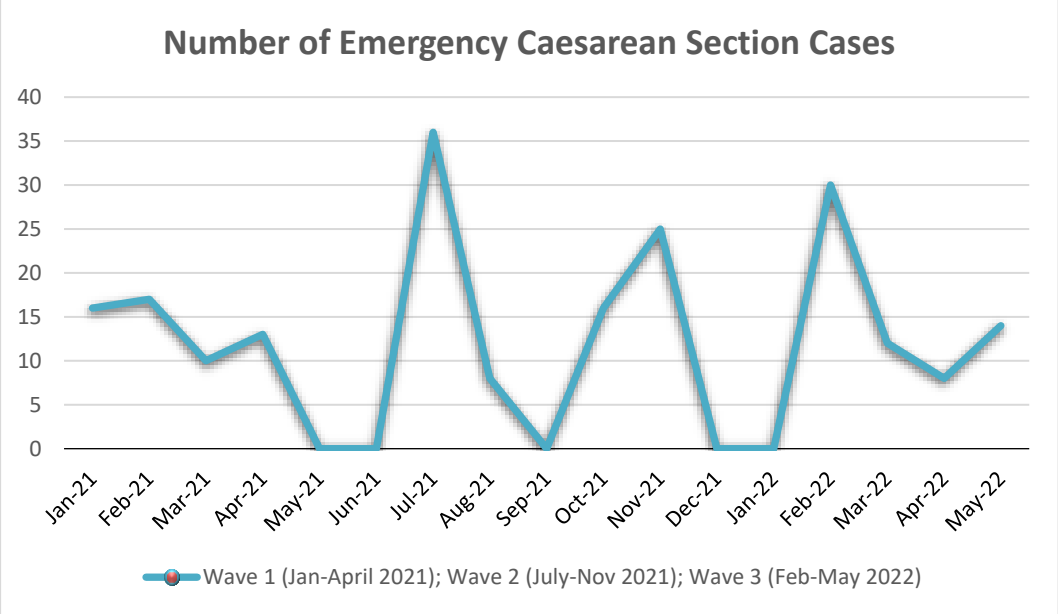
2. Methods

Retrospective observational analysis study, cross-sectional time series study of three waves of COVID-19 involving 205 emergency caesarean section patients divided into 56 patients in wave 1 (January 2021 – April 2021), 85 patients in wave 2 (July 2021-November 2021) and 64 patients in wave 3 (February 2022 – May 2022). The inclusion criteria were 1) emergency caesarean section in the Emergency Room at Dr. RSUP. Kariadi Semarang, and 2) complete medical records of patients who underwent emergency caesarean section. Exclusion criteria were 1) emergency caesarean section performed after failure of vaginal delivery, and 2) emergency caesarean section performed in the inpatient room. The independent variable of the study was response time for emergency caesarean section. The dependent variables of this study were maternal outcomes (blood transfusion, puerperal fever, surgical wound infection, hysterectomy, postpartum hemorrhage, and maternal death) and perinatal outcomes (APGAR score, need for resuscitation, prematurity, and infant death). Confounding variables are the hour of the event (hour of day), the day of

the event (day of week). Chi-square test and Fischer Exact test were used to analyze with significant results if $p<0.05$

3. Results

Assessment of medical record data for patients undergoing emergency caesarean section during the COVID-19 pandemic at RSUP dr. Kariadi Semarang found 218 subjects. The assessment of exclusion criteria was applied so that 13 subjects were excluded because 2 subjects underwent emergency caesarean section due to failed vaginal delivery and 11 subjects underwent emergency caesarean section determined in the inpatient room. A total of 205 subjects met the inclusion criteria, divided into 56 subjects undergoing emergency caesarean section during COVID-19 wave 1, 85 subjects undergoing emergency caesarean section during COVID-19 wave 2 and 64 subjects undergoing emergency caesarean section during COVID-19 wave 3.



Picture 1. Number of emergency caesarean section cases based on COVID-19 waves

The highest number of emergency caesarean section cases occurred during the 2nd wave of COVID-19, namely July 2021, with cases reaching 36 patients, followed by the 3rd wave of COVID-19, namely February 2022, with cases reaching 30 patients.

Table 1. Research subject demographics based on COVID-19 waves

Variable	COVID-19 Wave 1 (n=56)	COVID-19 Wave 2 (n=85)	COVID-19 Wave 3 (n=64)	*p*
COVID-19 infection				0.686[†]
• Yes	13 (23.2)	25 (29.4)	16 (25)	
• No	43 (76.8)	60 (70.6)	48 (75)	
Response time				0.341[‡]
• ≤ 30 minutes	0 (0)	2 (2.4)	0 (0)	
• > 30 minutes	56 (100)	83 (97.6)	64 (100)	
Indications for emergency caesarean section				

Variable	COVID-19 Wave 1 (n=56)	COVID-19 Wave 2 (n=85)	COVID-19 Wave 3 (n=64)	*p*
• Fetal distress	6 (10.7)	21 (24.7)	10 (15.6)	0.089†
• Antepartum hemorrhage	5 (8.9)	7 (8.2)	7 (10.9)	0.849†
• Prolonged labour	4 (7.1)	3 (3.5)	2 (3.1)	0.571‡
• Transverse presentation	0 (0)	3 (3.5)	1 (1.6)	0.469‡
• Severe preeclampsia / eclampsia	6 (10.7)	8 (9.4)	10 (15.6)	0.487†
• >1 indication	35 (62.5)	43 (50.6)	34 (53.1)	0.365†
Hour of the event				0.862†
• 07.00-13.59	19 (33.9)	23 (27.1)	19 (29.7)	
• 14.00-20.59	17 (30.4)	26 (30.6)	22 (34.4)	
• 21.00-06.59	20 (35.7)	36 (42.4)	23 (35.9)	
Day of the event				0.369†
• Weekdays	44 (78.6)	58 (68.2)	48 (75)	
• Weekend	12 (21.4)	27 (31.8)	16 (25)	
Mother's Age	32.04 ± 6.13; 31 (19-45)	31.39 ± 5.85; 31 (19-49)	32.02 ± 5.79; 32 (19-44)	0.750§
Gestational Age	37.52 ± 2.08; 38 (33-42)	37.54 ± 2.51; 38 (30-42)	37.13 ± 2.61; 38 (29-41)	0.563¶
G				0.101‡
• 1	14 (25)	36 (42.4)	19 (29.7)	
• 2	23 (41.1)	24 (28.2)	19 (29.7)	
• 3	9 (16.1)	19 (22.4)	17 (26.6)	
• 4	6 (10.7)	4 (4.7)	9 (14.1)	
• 5	2 (3.6)	1 (1.2)	0 (0)	
• 6	1 (1.8)	1 (1.2)	0 (0)	
• 7	1 (1.8)	0 (0)	0 (0)	
P				0.115‡
• 0	17 (30.4)	38 (44.7)	21 (32.8)	
• 1	25 (44.6)	30 (35.3)	24 (37.5)	
• 2	10 (17.9)	15 (17.6)	14 (21.9)	
• 3	2 (3.6)	0 (0)	5 (7.8)	
• 4	2 (3.6)	2 (2.4)	0 (0)	
A				0.521‡
• 0	43 (76.8)	73 (85.9)	54 (84.4)	
• 1	9 (16.1)	9 (10.6)	6 (9.4)	
• 2	2 (3.6)	3 (3.5)	4 (6.3)	
• 3	1 (1.8)	0 (0)	0 (0)	
• 4	1 (1.8)	0 (0)	0 (0)	

†*Chi-square*; ‡*Fischer exact*; §*One Way Annova*; ¶*Kruskall Wallis*; significant p<0.05

There were no significant differences in the demographic characteristics of research subjects between waves of COVID-19, both in the incidence of COVID-19 infection (p=0.686), response time (p=0.341), indication for emergency caesarean section, hour of the event (p=0.862), day of the event (p=0.369), maternal age (p=0.750), gestational age (p=0.563), number of gravida (p=0.101), number of parities (p=0.115) and number of abortions (p=0.521) between subjects study.

Table 2. Differences in maternal and infant outcomes according to pandemic phase/wave

Variable	COVID-19 Wave 1 (n=56)	COVID-19 Wave 2 (n=85)	COVID-19 Wave 3 (n=64)	*p*
Blood transfusion				0.803
• Yes	2 (3.6)	2 (2.4)	3 (4.7)	
• No	54 (96.4)	83 (97.6)	61 (95.3)	
Puerperal fever				1.000
• Yes	0 (0)	0 (0)	0 (0)	
• No	56 (100)	85 (100)	64 (100)	
Surgical site infection				1.000
• Yes	0 (0)	0 (0)	0 (0)	
• No	56 (100)	85 (100)	64 (100)	
Hysterectomy				0.585
• Yes	0 (0)	0 (0)	1 (1.6)	
• No	56 (100)	85 (100)	63 (98.4)	
Postpartum hemorrhage				0.687
• Yes	2 (3.6)	1 (1.2)	1 (1.6)	
• No	54 (96.4)	84 (98.8)	63 (98.4)	
Maternal death				0.341
• Yes	0 (0)	2 (2.4)	0 (0)	
• No	56 (100)	83 (97.6)	64 (100)	
APGAR score				0.632‡
• Normal	46 (82.1)	77 (90.6)	53 (82.8)	
• Mild asphyxia	5 (8.9)	3 (3.5)	3 (4.7)	
• Moderate asphyxia	2 (3.6)	2 (2.4)	4 (6.3)	
• Severe asphyxia	3 (5.4)	3 (3.5)	4 (6.3)	
Need for resuscitation				0.260†
• Yes	10 (17.9)	8 (9.4)	11 (17.2)	
• No	46 (82.1)	77 (90.6)	53 (82.8)	
Prematurity				0.339‡
• Extremely preterm	0 (0)	0 (0)	0 (0)	
• Very preterm	0 (0)	2 (2.4)	4 (6.3)	
• Moderate to late preterm	17 (30.4)	20 (23.5)	15 (23.4)	
• Aterm	39 (69.6)	63 (74.1)	45 (70.3)	
Infant death				0.623‡
• Yes	1 (1.8)	2 (2.4)	0 (0)	
• No	55 (98.2)	83 (97.6)	64 (100)	

†Chi-square; ‡Fischer exact; significant $p<0.05$

There were no significant differences in maternal and infant outcomes between waves of COVID-19 in terms of the need for blood transfusions (p=0.803), puerperal fever (p=1.000), surgical site infections (p=1.000), hysterectomy (p=0.585), bleeding postpartum (p=0.687), maternal death (p=0.341), APGAR score (p=0.632), need for resuscitation (p=0.260), prematurity (p=0.339) and infant death (p=0.623).

Table 3. The relationship between response time and maternal and infant outcomes

Variable	Response Time ≤ 30 minutes (n=2)	Response Time > 30 minutes (n=203)	*p*
Blood transfusion			1.000
• Yes	0 (0)	7 (3.4)	
• No	2 (100)	196 (96.6)	
Puerperal fever			1.000
• Yes	0 (0)	0 (0)	
• No	2 (100)	203 (100)	
Surgical site infection			1.000
• Yes	0 (0)	0 (0)	
• No	2 (100)	203 (100)	
Hysterectomy			1.000
• Yes	0 (0)	1 (0.5)	
• No	2 (100)	202 (99.5)	
Postpartum hemorrhage			1.000
• Yes	0 (0)	4 (2)	
• No	2 (100)	199 (98)	
Maternal death			1.000
• Yes	0 (0)	2 (1)	
• No	2 (100)	201 (99)	
APGAR score			1.000
• Normal	2 (100)	174 (85.7)	
• Mild asphyxia	0 (0)	11 (5.4)	
• Moderate asphyxia	0 (0)	8 (3.9)	
• Severe asphyxia	0 (0)	10 (4.9)	
Need for resuscitation			1.000
• Yes	0 (0)	29 (14.3)	
• No	2 (100)	174 (85.7)	
Prematurity			0.487
• Extremely preterm	0 (0)	0 (0)	
• Very preterm	0 (0)	6 (3)	
• Moderate to late preterm	1 (50)	51 (25.1)	
• Aterm	1 (50)	146 (71.9)	
Infant death			1.000
• Yes	0 (0)	3 (1.5)	
• No	2 (100)	200 (98.5)	

‡Fischer exact; significant $p<0.05$

There is no relationship between maternal and infant outcomes and the speed of emergency caesarean section response time in the COVID-19 era, whether for the need for blood transfusions (p=1.000), childbed fever (p=1.000), surgical site infections (p=1.000), hysterectomy (p=1.000), postpartum hemorrhage (p=1.000), maternal death (p=1.000), APGAR score (p=1.000), need for resuscitation (p=1.000), prematurity (p=0.487) and infant death (p=1.000).

4. Discussion

In this study, the need for blood transfusions was the most frequently reported maternal outcome during COVID-19 wave 1, COVID-19 wave 2 and wave 3. However, maternal deaths were only reported

during COVID-19 wave 2. There was no significant difference regarding the need for blood transfusions , the incidence of childbed fever, surgical site infections, hysterectomy, postpartum hemorrhage and maternal death in mothers undergoing SSE during COVID-19 wave 1, COVID-19 wave 2 and COVID-19 wave 3.

Ashipala DO, et al in their research stated that postpartum hemorrhage (3%) and anemia (1.5%) were the most common maternal complications found.[6] Kattel P in research related to feto-maternal outcomes of mothers undergoing emergency caesarean section found that 4.9% of mothers experienced postpartum hemorrhage (4.9%), puerperal fever (2.4%) and surgical wound infections (2.4%).[7] Darnal N, et al in their research stated that in mothers undergoing emergency caesarean section, the most frequently reported maternal complications were surgical wound infections (33.5%), postpartum hemorrhage (18.8%), urinary tract infections (16.4%), need blood transfusion (14.1%), fever (11.7%) and need for ICU care (10.5%).[8]

Pregnancy is a very important event in a woman's life journey. If a cesarean section is performed correctly, it can improve the overall outcome of the newborn and mother. However, if done incorrectly, the potential harm can outweigh the potential benefits of a cesarean section.[8] RSUP dr. Kariadi Semarang is a government tertiary health service center where patients are referred from all regions. This explains the higher number of caesarean sections compared to what WHO recommends.

In this study, the incidence of asphyxia, the need for resuscitation and prematurity were more common in COVID-19 wave 1, while infant deaths were more common in COVID-19 wave 2.

Ashipala DO, et al in their research stated that prematurity (8.5%) and transient tachpnea of the newborn (3.5%) were the most common complications found in babies.[6] Kattel P in research related to feto-maternal outcomes of mothers undergoing emergency caesarean section found that 19.5% of babies had an APGAR score <7 in the first minute, 17.1% of babies needed resuscitation, and 14.6% of babies needed NICU care.[7]

Perinatal deaths are most often caused by birth asphyxia. [9] Onankpa et al stated that the perinatal mortality rate was 11 per 1000 in cesarean delivery.[10] The high perinatal mortality rate may occur due to less than optimal care due to inadequate human resources. Even though the fetus can be detected in a timely manner, referral is not easy to do because of the distance between the referring hospital and the unpredictable condition of the highway. Another reason that increases the perinatal death rate is that caesarean sections are carried out for reasons of fetal distress in conditions that are close to death. Severe newborn morbidity is associated with birth asphyxia due to prolonged labor and late intervention to prevent perinatal morbidity and mortality. Close monitoring of labor, early detection of complications and timely decision for cesarean delivery are essential.[11]

In this study, although there was no relationship between response time in minutes and maternal and infant outcomes, it was found that maternal and infant outcomes were better at response times < 30 minutes compared to > 30 minutes (lower need for blood transfusion, lower maternal mortality, score The APGAR was completely normal, the need for resuscitation was lower, the incidence of prematurity was

lower and the infant mortality rate was lower in the response time group < 30 minutes compared to > 30 minutes).

Gunawan T, et al who assessed the relationship between emergency cesarean section response time and perinatal outcomes at RSUP dr. Sardjito obtained the results that the average response time was 115 ± 52 minutes. There was no association between perinatal outcomes between the response time ≥115 minutes Apgar score group, need for CPAP, infant death, ventilator, NICU care, meconium aspiration syndrome and hypoxic ischemia encephalopathy compared with the response time <115 minutes group ($p>0.05$).[12] Berguna JSN, et al. who conducted a systematic review of research regarding the relationship between response time and the outcomes of mothers and babies undergoing caesarean section operations in categories 1 and 2, found that response time did not affect the outcomes of mothers and babies.[13]

The absence of a relationship between response time and perinatal outcomes in the research conducted could be due to neonatal resuscitation measures during intrauterine or postpartum. Roy et al in their research stated that response time >30 minutes had no effect on perinatal outcomes. Fetuses with a response time >30 minutes may receive intrauterine resuscitation through positioning the mother on her left side, administering intravenous hydration, and administering oxygen to the mother. This can improve the condition of fetal hypoxia towards improvement to a certain extent until an emergency caesarean section is performed.[14]

Astuti DP, et al who evaluated response time and maternal outcomes in the form of postpartum hemorrhage also obtained similar results that there was no relationship between response time and successful treatment of postpartum hemorrhage ($p=0.810$). If we look at the variable of place of first birth which is related to response time, the results show that the place of first birth is mostly at home with a slow response time (65.52%). Respondents who gave birth at home were 3.93 times more likely to experience a slow response time. The evaluation also found that a late referral time was 3.78 times greater risk of experiencing a slow response time.[15] The large number of other variables that can influence the speed of response time and maternal/infant outcomes are thought to have caused the insignificant results in this study.

Although there is no significant relationship between response time and maternal and infant outcomes, other studies state that maternal outcomes with emergency caesarean section response times ≤30 minutes have fewer cases of bleeding, no symptoms of postoperative fever, and a higher mean postoperative hemoglobin. higher when compared with the response time for emergency caesarean section > 30 minutes. In addition, emergency caesarean section response time ≤30 minutes does not require postoperative ICU care, does not require hysterectomy, and there is no maternal death, while emergency caesarean section response time >30 minutes requires post-operative ICU care, there is hysterectomy, and death Mother. The outcome of babies with a cesarean section response time of ≤30 minutes has a normal APGAR score, no need for breathing aids and CPAP intubation, no need for NICU care, no incidence of meconium aspiration syndrome, and no neonatal death, whereas with emergency cesarean section response time >30 minutes

have mild, moderate, to severe asphyxia, require breathing assistance and CPAP intubation, require NICU, experience meconium aspiration syndrome, experience neonatal death.[16]

5. Conclusion

The length of response time did not affect the outcomes of mothers and babies in this study, so it is necessary to evaluate other factors such as the severity of COVID-19, vital signs of mothers and babies, emergency handling of mothers and babies and the number of human resources, which are strongly suspected affect the outcome.

Conflicts of Interest

There is no conflict of interest in this research

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