The Journal of Obstetrics and Gynecology of India (March–April 2023) 73(2):132–138
https://doi.org/10.1007/s13224-022-01693-0

ORIGINAL ARTICLE

Crash Caesarean Delivery: How to Optimise Decision-to-Delivery Interval by Initiating a Novel Code? A Clinical Audit

Vakkanal Paily Paily[1] · Raji Raj Girijadevi[1] · Sachin George[2] · Abdul Tawab[3] · Afshana Sidhik[1] · Ajithakumari Sudhamma[1] · Joshy Joseph Neelankavil[1] · M. G. Usha[1] · Raymond George[1] · Soumya Ramakrishnan[1] · Sara Cheriyan[1] · Manu Pradeep[1] · Anu Mathai[1]

Received: 3 April 2022 / Accepted: 12 July 2022 / Published online: 8 August 2022
© Federation of Obstetric & Gynecological Societies of India 2022

Abstract

Background Many resource-constrained centres fail to meet the international standard of 30 min of decision-to-delivery interval (DDI) of Category-1 crash caesarean deliveries. However, specific scenarios like acute foetal bradycardia and antepartum haemorrhage necessitate even faster interventions.

Methods A multidisciplinary team developed a "CODE-10 Crash Caesarean" rapid response protocol to limit DDI to 15 min. A multidisciplinary committee analysed a retrospective clinical audit of maternal–foetal outcomes over 15 months (August 2020–November 2021), and expert recommendations were sought.

Results The median DDI of twenty-five patients who underwent a "CODE-10 Crash Caesarean delivery" was 13 ± 6 min, with 92% (23/25) of DDIs falling below 15 min. Seven neonates required intensive care for more than 24 h with no maternal or neonatal mortality. DDIs during office and non-office hours were not significantly different (12.5 ± 6 min vs 13 ± 5 min, $p = 0.911$). Transport delays caused the two instances of DDI > 15 min.

Vakkanal Paily Paily (MD, FRCOG), Senior Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Raji Raj Girijadevi (MS, MRCOG), Senior Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Sachin George (DNB, DA), Senior Consultant, Department of Anaesthesiology, Rajagiri Hospital, Kochi, Kerala, India; Abdul Tawab (CN), Consultant, Department of Neonatology, Rajagiri Hospital, Kochi, Kerala, India; Afshana Sidhik (MS, FFM), Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Ajithakumari Sudhamma (MD, DGO), Senior Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Joshy Joseph Neelankavil (MD, DNB, MRCOG), Senior Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; M.G. Usha (MD), Senior Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Raymond George (MD, DNB, FNB), Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Soumya Ramakrishnan (MS), Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Sara Cheriyan (MS), Consultant, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Manu Pradeep (MBBS), Research Officer, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India; Anu Mathai (BSc.) Head Nurse, Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India.

Extended author information available on the last page of the article

Conclusion The novel "CODE-10 Crash Caesarean" protocol may be feasible for adoption in a similar tertiary-care setting with appropriate planning and training.

Keywords Caesarean section · Decision-to-delivery interval · Quality improvement · Patient safety

Introduction

During several obstetric emergencies, immediate caesarean deliveries are required. The Royal College of Obstetricians and Gynaecologists and the American College of Obstetricians and Gynecologists have set a standard of 30 min for decision-to-delivery interval in Category 1 (Urgent) caesarean deliveries [1–3]. However, these standards are rarely met, particularly in low-resource settings, with several authors questioning their value [4, 5].

However, in scenarios like acute foetal bradycardia or antepartum haemorrhage, a delivery delay of even 30 min can compromise maternal–foetal outcomes. A novel "CODE-10 Crash Caesarean" announcement promptly activates the multidisciplinary team required to perform a "crash" caesarean delivery within minutes. Thereby, we hoped to further limit the decision-to-delivery interval (DDI) [6], to 15 min by adopting a modified multidisciplinary protocol [7] in our tertiary care setting. This study evaluates the feasibility of the new "CODE-10 Crash Caesarean" by analysing maternal–foetal outcomes and its operational challenges over 15 months in a tertiary-care hospital in India. In addition, we further discuss pragmatic strategies to reduce DDI in crash caesarean deliveries.

Materials and Methods

"CODE-10 Crash Caesarean" is an emergency protocol, activated by the obstetric team via the hospital public address system, when the need to perform a Category-1 "Crash" emergency caesarean delivery is identified. In our centre, we take the following as indications for "CODE-10 Crash Caesarean": (i) acute foetal bradycardia (or a single deceleration lasting more than 3 min) [8], (ii) severe antepartum haemorrhage with foetal or maternal compromise, (iii) cord prolapse and (iv) suspected uterine rupture or scar dehiscence. Notably, not all pathological cardiotocogram (CTG) traces [9] are considered as indications. This protocol rapidly alerts all concerned team members from the three departments—Obstetrics and Gynaecology, Anaesthesiology and Neonatology, who rush to the labour room operation theatre (LR-OT), to rapidly facilitate foetal delivery within 15 min (Fig. 1). The primary surgeon/team leader is always an OBG consultant (faculty) with 2–10 years of surgical expertise. Another consultant of similar grade or an OBG resident often serves as the assistant surgeon.

Developing "CODE-10 Crash Caesarean"

"CODE-10 Crash Caesarean" was conceptualised by four senior obstetrician-gynaecologists with 30–50 years of experience in maternal–foetal medicine in our tertiary care teaching hospital, conducting ~ 1500 deliveries per year. The concept was discussed before a

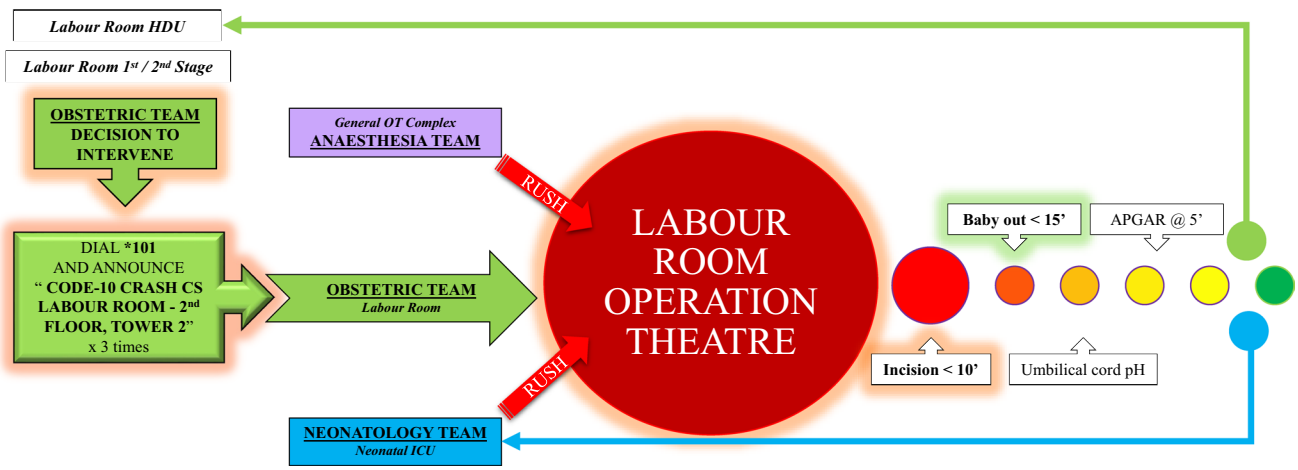

Fig. 1 "CODE-10 Crash Caesarean" code steps

multidisciplinary committee, consisting of representative consultants and nurses (with 2–15 years of clinical experience) from Obstetrics & Gynaecology, Anaesthesiology and Neonatology. These participants were the primary duty staff who were most likely to attend crash caesarean deliveries. After the first round of discussions, a preliminary protocol was formulated, and this new code was trialled as part of the existing hospital emergency code directory. The pertinent clinical staff of all involved departments were familiarised with the new system, via on-site training sessions, following which "CODE-10 Crash Caesarean" underwent a trial phase of 6 months. At the end of the trial phase, the second round of discussions was held, where the operational directives, depicted in Fig. 2, were finalised and disseminated via a final training session to all concerned department personnel. The obstetric team oversaw data collection and analysis of the "CODE-10 Crash Caesarean" audit daily.

Study Design, Setting, Population

With Institutional Ethics Committee clearance, the maternal–foetal outcomes between 1 August 2020 and 1 November 2021 were analysed in the third round of committee discussion. Qualitative observations and recommendations for improving the novel CODE-10 were sought. All consecutive patients who underwent a "CODE-10 Crash Caesarean" delivery during the study period were included for analysis.

The primary outcome is the DDI, which must be limited to 15 min, which is a much more stringent standard than advocated by international organisations (30 min) [5] but may ensure better maternal–foetal outcomes even if the DDI overshoots by a few minutes. Secondary outcomes include maternal and foetal morbidity/mortality. Differences in DDI between office hours (9:00 am–5:00 pm) and non-office hours (5:01 pm–8:59 am) were analysed to evaluate the performance of the code with minimal staffing. This was detected as nonparametric using a Shapiro–Wilk test and was compared using the Mann–Whitney U test, with $p \leq 0.05$

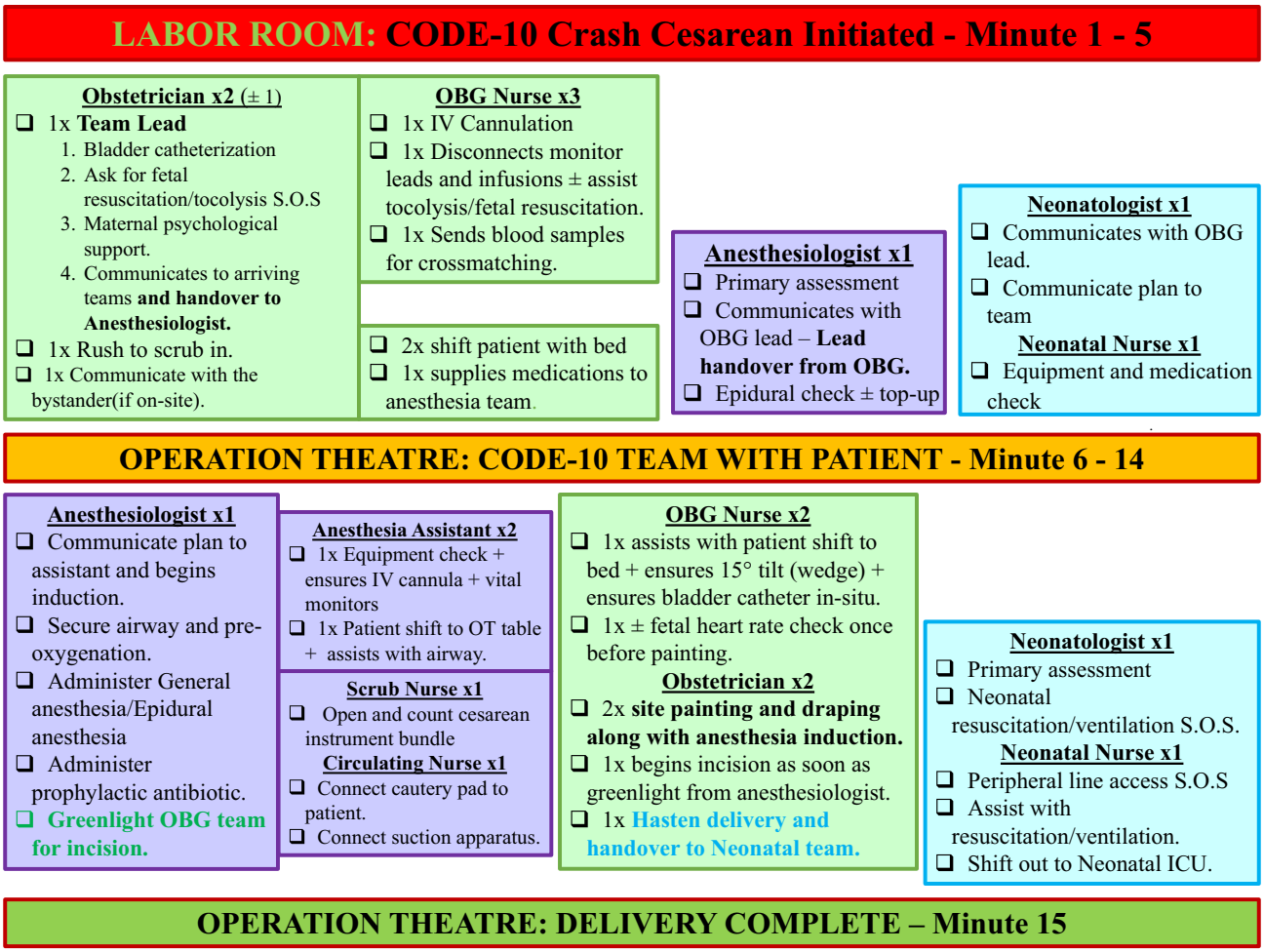

Fig. 2 "CODE-10 Crash Caesarean" personnel protocol

(2-tailed) denoting statistical significance. Data analysis was performed in SPSS version 26 (IBM Corp. Armonk, USA).

Results

"CODE-10 Crash Caesarean" audit

There were 1730 deliveries during the study period, of which 578 (33.4%) were conducted as caesarean delivery (Primary caesarean delivery, $n = 261$, 15.1%). Figure 3 demonstrates the maternal or foetal indications for the twenty-five (4.32%) "CODE-10 Crash Caesareans" initiated by the obstetric team, while Table 1 demonstrates the maternal–foetal characteristics and DDIs of the participants analysed.

All neonates had a good APGAR score of 8–9 at the 5-min interval. The cohort had no maternal morbidity or mortality, but at least seven neonates required more than 24 h of intensive care for respiratory support.

The two outliers—one patient with a DDI of 16 min, "CODE-10 Crash Caesarean" was indicated for acute foetal bradycardia (umbilical artery pH = 6.96, S. lactate = 6.7 mmol/L) (umbilical vein pH = 6.98, S. lactate = 5.9 mmol/L). The female neonate weighing 2715 gm was not in distress and had good APGAR scores. Hence, she was discharged along with the mother, who had an uneventful post-caesarean section recovery.

Another mother with a DDI of 17 min, the "CODE-10 Crash Caesarean" was called for an abruptio placenta (umbilical artery pH = 7.11, S. lactate = 5 mmol/ L) (umbilical vein pH = 7.18, S. lactate = 4.4 mmol/L). Again, the mother recovered uneventfully. However, a female neonate weighing 3005 gm required invasive ventilation and associated 36-day intensive care for the sequelae of the perinatally diagnosed gram-negative sepsis—but recovered satisfactorily.

These two instances of 1- to 2-min prolongation of DDI were found to be due to patient "labour room to OT" transport delays. These CODE-10 s were called between 11:00 pm and 01:00 am when we were relatively short-staffed with other concurrent deliveries occurring.

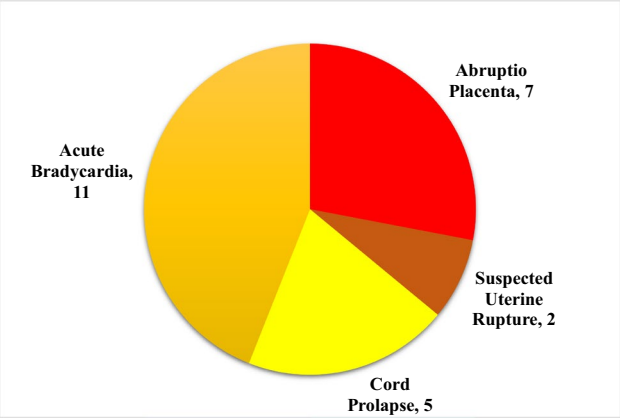

Fig. 3 "CODE-10 Crash Caesarean" indications

Observations and Recommendations

After a qualitative audit analysis during the third round of multidisciplinary committee meeting, we formulated a set of observations and recommendations to minimise sub-intervals of DDI, as defined by May et al. 2022[6].

i. TRANSFER TIME –

a. Early detection of maternal/foetal compromise was made possible by an on-duty obstetric consultant, an OBG trainee, and experienced nursing staff in the labour room.
b. The public address system enabled a quick 10-s, hospital-wide alert to multidisciplinary teams on duty. In obstetric units in developing nations, the salience of such an infrastructural upgrade cannot be overstated, as delay in team arrival is a common cause for a prolonged DDI. The proximity of the obstetric wing to the neonatal ICU (~ 20 m) and the general OT complex (~ 36 m) within the same

Table 1 Cohort characteristics and decision-to-delivery interval (DDI) analysis

Variables	Outcome		
Age, median ± IQR	29 ± 6 years		
Primiparous, n (%)	19 (74%)		
DDI < 15 min, n (%)	23 (92%)		
DDI, median ± IQR	13 ± 6 min		
DDI in duty hours (9:00 am to 5:00 pm)	12.5 ± 6 min	$U = 73$	$p = 0.911$
DDI in non-office hours (5:01 pm to 8:59 am)	13 ± 5 min		
Neonatal pH < 7.0, n (%)	3 (12%)		
Regional anaesthesia, n (%)	4 (16%)		

Decision-to-delivery interval (DDI) analysed using Mann–Whitney U test

hospital floor also enabled a quick assembly of the on-duty team members on calling the code.

c. After the decision to intervene has been made (usually after a vaginal examination), the attending obstetrician must immediately catheterise the bladder, under the same sterile setting used for vaginal examination. Catheterisation is a crucial step that causes delays. Obstetricians must then communicate the urgency of the scenario coherently and reassuringly (using layman terms) to the mother and the companion (if present). However, no fresh informed consents are necessary, as such consents must have been obtained prior to admission at the centre.
d. Careful optimisation of the patient transport path from the labour room to the OT is essential to minimise transport delays. In our centre, pathways to the LR-OT are at least 3 m wide and a maximum distance of 6 m from first- and second-stage labour rooms, with no permanent (steps, structural pillars) or temporary (furniture) structures obstructing it at any given time. All doors are wide enough to allow transport of the delivery bed. We swapped out conventionally larger or immobile patient beds in our 1st stage rooms, in favour of mobile and narrower delivery beds. Valuable minutes can be saved by shifting the patient in the mobile beds they occupy (instead of first shifting them to a trolley) and then using patient rollers/ patient sliding boards [10] to shift them to the operating table.

ii. ANAESTHETIC TIME –

a. While the choice of anaesthesia is individualised [11], general anaesthesia is often quicker [12].
b. However, if the patient is under epidural anaesthesia, we only need to provide another bolus dose to save even more time and potentially reduce the risk of aspiration from general anaesthesia under a non-fasting state [13].

iii. INCISION TIME –

a. The LR-OT must have a sterile caesarean delivery instrument bundle at all times.
b. The obstetrician can save time by simultaneously painting and draping the patient, while the anaesthesia induction is underway—so an incision can be made as soon as possible.

iv. DELIVERY TIME –

a. The choice of abdominal and uterine incision is dependent on the operative scenario and the surgeon's expertise. A Joel Cohen type abdominal incision may be used so that after the skin incision, further progression is mostly by stretching rather than cutting [14].
b. No attempt is made to arrest minor bleeding vessels while hastening the abdominal incision.

General considerations

a. **Resource allocation—**At least one LR-OT, exclusively reserved for emergency caesarean deliveries, must be attached to the obstetric wing.
b. **Staff training—**Training and acclimatisation to the new code during the 6-month trial phase imbued confidence in all involved staff to handle such obstetric emergencies according to the pre-determined protocol, minimising any incident delays. A multi-department, bi-annual training and mock trial of "CODE-10" for incumbent staff may be necessary—especially for the benefit of the new team members.

Discussion

Our CODE-10 team achieved an impressive success rate in improving on international standards by limiting DDI to 15 min to all but two cases of Category-1 caesarean deliveries. Interdepartmental collaboration and accountability have been integral in materialising this essential code in our centre. No longer is the obstetric team scrambling to alert multiple on-call specialists about an imminent emergency caesarean delivery, and the entire process has been simplified to a 5 second phone announcement. While the code was systematically implemented, the daily monitoring of its progress enabled the obstetric team to address practical difficulties associated with staffing patterns, equipment failures and transportation mechanisms in a real-time fashion. This has undeniably led to streamlined obstetric emergency care, even during non-office hours. With this ongoing or "living" clinical audit, we hope a similar positive outcome will continue to be observable in the coming years.

Other high-volume centres in India and resource-constrained settings across the globe often struggle to limit DDI to even 30 min [15–19], and as a consequence, some have reported worse maternal and foetal outcomes. To the best of our knowledge, the current audit is the first study from India demonstrating that such rapid response teams can attain the 15-min DDI target. These ambitious targets were previously limited to centres in developed nations that enacted similar rapid response colour codes, which reported no significantly different neonatal outcomes [20–25]. However, some authors have warned that such novel codes can

be overused for non-life-threatening indications, potentially compromising maternal safety for a shorter DDI [26].

Recently, Boriboonhirunsarn and Sunsaneevithayakul [27] inducted a similar code "Code Blue", in a resource-constrained centre to limit DDI to 30 min. However, they did not limit interventions to acute bradycardia as we did, but rather intervened in all NICHD Category III CTG patterns [9]. They demonstrated a significant reduction in DDI in a large cohort of 150 patients; to a mean of 22 min (after code induction) from 52.5 min (prior to code induction) and did not observe any significantly different neonatal outcomes.

This pilot study is unique to the best of our knowledge. Compared to similar studies, the indications for a "CODE-10 Crash Caesarean" delivery are highly selective—only acute foetal bradycardia or "a single prolonged deceleration of greater than 3 min" (out of all other pathological CTG patterns) has been considered for such rapid procedures, along with other conventional Category-1 indications. This prohibited unnecessary crash caesarean deliveries in several women with pathological/non-reassuring CTG traces, who were managed more conservatively. Relative to other pathological patterns, the acute bradycardia foretells a hyperacute foetal insult, which requires a rescue within 10–15 min and not 30 min. We believe that similar multidisciplinary teams can easily adapt our novel code and expert recommendations to minimise DDI in their tertiary care centres.

Consequently, all aspects of this CODE-10 protocol may not be generalisable to all delivery points, i.e. secondary care centres without round-the-clock anaesthesia, neonatology and adequate clinical as well as support staff. However, DDI still can be optimised using our general guidelines for the obstetric team. An uncoordinated team can compromise maternal safety during such hyper-accelerated interventions, even before the patient reaches the operation theatre, such as patient transport and medicine safety. Surgeons must anticipate anaesthetic/operative delays and complications in high-risk patients with hypertensive, diabetic, cardiac or bleeding disorders.

The current study is primarily limited by the lack of a historical control data as a reference, for analysing DDI improvements in the same setting. Due to the rapid nature of the code and limited personnel involved during non-office hours, sub-intervals of DDI like "transfer time" or "anaesthetic time" could not be reliably measured in this series [6].

Conclusion

This small clinical audit and its outcomes stand resolute as proof that rapid response systems are replicable in obstetric units with appropriate hospital design, around-the-clock availability of a modest crew of CODE-10 trained clinical staff and strong inter-departmental collaboration. We expect this novel code system to continue delivering positive maternal and neonatal outcomes for years.

Acknowledgements We are grateful to the clinical and administrative staff of Rajagiri Hospital—Aluva, whose sincere efforts enabled this novel code to be implemented and audited.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical consideration This study was performed in line with the principles of the Declaration of Helsinki. Ethical approval was provided by the Rajagiri Hospital Institutional Ethics Committee (ref. RAJH/A/2021/008). Informed consent was obtained from all individual participants included in the study.

References

1. American Academy of Pediatrics, American College of Obstetricians and Gynecologists. *Guidelines for perinatal care*. 8th ed. 2017. ACOG https://www.acog.org/en/store/products/clinical-resources/guidelines-for-perinatal-care. Accessed 17 November 2021.
2. Royal College of Obstetricians and Gynaecologists, Royal College of Midwives, Royal College of Anaesthetists, Royal College of Paediatrics and Child Health. Standards for Maternity Care - Working Party Report. 2008 https://www.rcog.org.uk/globalassets/documents/guidelines/wprmaternitystandards2008.pdf. Accessed 17 November 2021.
3. Lucas DN, Yentis SM, Kinsella SM, et al. Urgency of caesarean section: a new classification. J R Soc Med. 2000;93(7):346–50.
4. Livermore LJ, Cochrane RM. Decision to delivery interval: a retrospective study of 1,000 emergency caesarean sections. J Obstet Gynaecol. 2009;26(4):307–10.
5. Tomlinson JH, Lucas DN. Decision-to-delivery interval: Is 30 min the magic time? What is the evidence? Does it work? Best Pract Res Clin Anaesthesiol. 2017;31(1):49–56.
6. May RL, Clayton MA, Richardson AL, et al. Defining the decision-to-delivery interval at caesarean section: narrative literature review and proposal for standardisation. Anaesthesia. 2022;77(1):96–104.
7. Adedugbe IO, Carvalho JCA, Downey K, et al.. A team consensus on the allocation of resources, roles and tasks for emergency crash cesarean deliveries. J Clin Anesth. 2020;67: 109972.
8. NICE. Recommendations - Intrapartum care for healthy women and babies. National Institute for Health and Care Excellence. 2017. https://www.nice.org.uk/guidance/cg190/chapter/Recommendations#monitoring-during-labour. Accessed 26 February 2022.
9. Ayres-De-Campos D, Spong CY, Chandraharan E. FIGO consensus guidelines on intrapartum fetal monitoring: cardiotocography. Int J Gynecol Obstet. 2015;131(1):13–24.
10. Vinstrup J, Jakobsen MD, Madeleine P, Andersen LL. Biomechanical load during patient transfer with assistive devices: Cross-sectional study. Ergonomics. 2020;63(9):1164–74.
11. Apfelbaum JL, Hawkins JL, Agarkar M, et al. Practice Guidelines for Obstetric AnesthesiaAn Updated Report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia and the Society for Obstetric Anesthesia and Perinatology. Anesthesiology. 2016;124(2):270–300.

12. Bhatia K, Columb M, Bewlay A, et al. Decision-to-delivery interval and neonatal outcomes for category-1 caesarean sections during the COVID-19 pandemic. Anaesthesia. 2021;76(8):1051–9.
13. Maronge L, Bogod D. Complications in obstetric anaesthesia. Anaesthesia. 2018;73:61–6.
14. Stark M, Witzel K, Benhidjeb T, et al. Added value of surgical interdisciplinarity- The Joel-Cohen's abdominal incision. Ann Med Surg. 2021;67: 102455.
15. Gupta S, Naithani U, Madhanmohan C, et al. Evaluation of decision-to-delivery interval in emergency cesarean section: a 1-year prospective audit in a tertiary care hospital. J Anaesthesiol Clin Pharmacol. 2017;33(1):64.
16. Hughes NJ, Namagembe I, Nakimuli A, et al. Decision-to-delivery interval of emergency cesarean section in Uganda: a retrospective cohort study. BMC Pregnan Childbirth. 2020;20(1):1. https://doi.org/10.1186/S12884-020-03010-X.
17. Kitaw TM, Limenh SK, Chekole FA, et al. Decision to delivery interval and associated factors for emergency cesarean section: a cross-sectional study. BMC Pregnan Childbirth. 2021;21(1):1. https://doi.org/10.1186/S12884-021-03706-8.
18. Mishra N, Gupta R, Singh N. Decision delivery interval in emergency and urgent caesarean sections: need to reconsider the recommendations? J Obstet Gynaecol India. 2018;68(1):20–6.
19. Jain SM, Thool K, Jain MA, et al. Study on maternal and neonatal outcome of women undergoing caesarean section using NICE classification in a tertiary care hospital in rural area of Central India—an observational prospective study. Curr Women's Health Rev. 2021;18(1):92–9.
20. Bidon C, Desgranges FP, Riegel AC, et al Retrospective cohort study of decision-to-delivery interval and neonatal outcomes according to the type of anaesthesia for code-red emergency caesarean sections in a tertiary care obstetric unit in France. Anaesth Crit Care Pain Med. 2019;38(6):623–30.
21. le Mitouard M, Gaucher L, Huissoud C, et al. Decision-delivery intervals: Impact of a colour code protocol for emergency caesareans. Eur J Obstet Gynecol Reprod Biol. 2020;246:29–34.
22. Deltombe-Bodart S, Grabarz A, Ramdane N, et al. Compliance to the color codes protocol according to the indication of cesarean and to the decision-to-delivery interval. Gynecologie obstetrique fertilite senologie. 2018;46(7–8):575–9.
23. Benazza N, Touzart L, Muszynski C, et al. Impact of establishment of a color code in emergency caesareans in secondary health care maternity. J Gynecol Obstet Hum Reprod. 2019;48(4):261–4.
24. Taras J, Raghavan G, Downey K, et al. Obstetric emergencies requiring rapid response team activation: a retrospective cohort study in a high-risk tertiary care centre. J Obstet Gynaecol Can. 2022;44(2):167-174.e5.
25. Dunn CN, Zhang Q, Sia JT, et al. Evaluation of timings and outcomes in category-one caesarean sections: A retrospective cohort study. Indian J Anaesth. 2016;60(8):546–51.
26. Bloc F, Dupuis O, Massardier J, et al. Abuse-t-on des césariennes en extrême urgence ? [Are we overusing of crash c-section procedure?]. J Gynecol Obstet Biol Reprod. 2010;39(2):133–8.
27. Boriboonhirunsarn D, Sunsaneevithayakul P. A specific protocol to shorten the decision-to-delivery interval for emergency caesarean section. J Obstet Gynaecol. 2021. https://doi.org/10.1080/01443615.2021.1981267.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Authors and Affiliations

Vakkanal Paily Paily[1] · Raji Raj Girijadevi[1] · Sachin George[2] · Abdul Tawab[3] · Afshana Sidhik[1] · Ajithakumari Sudhamma[1] · Joshy Joseph Neelankavil[1] · M. G. Usha[1] · Raymond George[1] · Soumya Ramakrishnan[1] · Sara Cheriyan[1] · Manu Pradeep[1] · Anu Mathai[1]

✉ Vakkanal Paily Paily
vppaily@gmail.com

[1] Department of Obstetrics and Gynaecology, Rajagiri Hospital, Kochi, Kerala, India

[2] Department of Anaesthesiology, Rajagiri Hospital, Kochi, Kerala, India

[3] Department of Neonatology, Rajagiri Hospital, Kochi, Kerala, India