Maternal and neonatal outcomes based on appropriateness of indication and timing of surgery in red code caesarean section: a multicentre retrospective study

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Objective. A red code (RC) cesarean section (CS) is an emergency for maternal and/or fetal life. We evaluated maternal and neonatal outcomes in a series of RC CS, in relation to the level of maternal unit, indications and surgical times.

Materials and Methods. Multicentre retrospective study in 2 second-level university hospitals and 2 first-level community hospitals on all women who underwent RC CS between 2018 and 2021. An independent team of experts performed retrospective audits to assess appropriateness of indications, procedures and outcomes.

Results. Among the 25065 deliveries, 4783 were CS (19.1%), 168 of which (3.5%) were RC. The most frequent indication was non-reassuring fetal heart rate tracing (41.7%). Two indications were independently associated with worse perinatal outcomes: umbilical artery lactate > 7 mmol/L (P 0.023) and base excess (BE) ≥ 16 mmol/L (p = 0.016). Rates of appropriate indications were higher in the second-level hospitals (80.2% *vs* 65%, p = 0.036), as were rates of neonatal intubation (p = 0.001) and neonatal ICU admission (p = 0.001). Appropriate indications for RC CS correlated with higher maternal blood loss (p = 0.02), lactate values > 7 mmol/L (p = 0.001) and neonatal resuscitation (p = 0.02). After correcting for the appropriateness of indications, the time between decision and delivery (DDI-mean 21.0 minutes) was not associated with worse neonatal outcomes.

Conclusions. The DDI is not significantly associated with neonatal outcomes, as opposed to the appropriateness, which is associated with worse outcomes. First level maternal units guarantee safety comparable to second-level, but with lower rates of appropriate indications.

	APPROPRIATES	INAPPROPRIATES	MISSING	P-VALUE
Number of cases	119 (70.8%)	45 (26.8%)	4 (2.4%)	/
Maternal anamnesis				
Second-level hospitals	65	16	4	0.036
Maternal Age	32.8 (SE 0.5)	33.3 (SE 0.8)	4	0.599
BMI at delivery	28.8 (SE 0.5)	27.5 (SE 0.7)	22	0.168
Previous CS	14	8	4	0.315
Comorbility	25	10	4	0.834
Gestational age < 37	27	6	4	0.274
CS indications				
Fetal heart rate alterations	44	24	4	0.075
Sentinel event	49	13	4	0.206
Timing				
Decision-to-incision interval (min)	15.4 (SE 0.9)	20.4 (SE 1.7)	5	0.006
Decision-to-delivery interval (min)	19.4 (SE 1.0)	25.7 (SE 1.8)	4	0.002
Maternal outcomes				
Hospitalization post-CS (days)	4.6 (SE 0.3)	4.5 (SE 0.4)	6	0.900
Blood loss (mL)	636.3 (SE 54.2)	418.9 (SE 44.2)	6	0.019
Blood transfusion	9	0	5	0.064
Surgical complications	2	2	5	0.305
Neonatal outcomes				
UA pH	7.160 (SE 0.015)	7.241 (SE 0.018)	11	0.002
UA BE > -12	14	2	9	0.2
UA Lactates > 7	39	4	16	0.001
UA pO_2 (mmHg)	19.4 (SE 1.4)	16.5 (SE 1.6)	34	0.259
UA pCO_2 (mmHg)	60.6 (SE 2.1)	57.2 (SE 2.5)	20	0.365
Apgar score at 5 min < 7	25	5	4	0.178
Neonatal reanimation	45	7	5	0.008
Neonatal intubation	21	3	5	0.086
Neonatal ICU access	28	2	4	0.030
Hypothermia	6	1	5	0.675