Safety of high-dose rocuronium for emergency cesarean sections : retrospective study of neonatal and maternal outcomes

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Apgar score (average)	Appearance 1-min	Pulse 1-min	Grimace 1-min	Activity 1-min	Respiration 1-min	APGAR 1-min	p value
Sx group (n = 56)	0.16	1.73	1.27	1.29	1.3	5.8 ± 2.8	p = 0.89
Rb group (n = 95)	0.17	1.79	1.44	1.11	1.37	5.8 ± 2.5	
	5-min	5-min	5-min	5-miin	5-min	APGAR 5-min	
Sx group (n = 56)	0.91	1.98	1.64	1.57	1.73	7.8 ± 1.7	p = 0.87
Rb group (n = 95)	0.91	1.97	1.73	1.52	1.73	7.8 ± 1.5	

BACKGROUND :
High-dose rocuronium (Rb) for emergency ceasarean sections (c-sec) is often used instead of suxamethonium (Sx) for rapid sequence induction because of the noninferiority of maternal intubating conditions. However, there are no pricise studies in neonatal outcome with neuromuscular function, especially when they are non-reassuring in utero. The aim of this study was to determine whether high-dose Rb confer benefit both in maternal and neonatal outcomes in parturients undergoing general anaesthesia for emergency c-sec. In our previous study, as Apgar score was a total score, we investigated the breakdown of the score on a larger sample.

METHODS :
We analysed Rb group (n=95) and Sx group (n=56), total 151 emergency c-sec patients from 2010 to 2018. After preoxygenation, anaesthesia was induced with thiopental or propofol i.v. and muscle relaxant (Rb 0.9-1.4 mg/kg, Sx 1.0-1.8mg/kg) in Rapid sequence setting. About 60 seconds later, intubation was performed. Both group were reversed with sugamadex (Sgx) or neostigmine, before extubation. We assessed the number of intubation attempts, SpO2 desaturation (≥ 5%), time from incision to delivery (min) and residual neuromuscular blockade at end of surgery. Neonates were assessed using Apgar scores (5-items), acidosisi (pH), with or without intubation in the operating theatre. Fisher’s exact test, t-test and binomial logistic regression analysis was used for statistical analysis. Significance was designed at p < 0.05.

RESULTS AND DISCUSSION :
The two groups were well matched (Table 1). As shown in the table above, there were difference in the item of Activity and Grimace by muscle relaxant. There was significantly difference between Rb and Sx regarding naonatal Activity (< 2 points, Rb:62/95, Sx:26/56; p = 0.027). 1-min and 5-min total Apgar scores was similar between the groups. Failed first maternal intubation attempts did not differ between the groups (Rb:0/95; Sx:1/56; p = 1). Tow patients in Sx group and nine patients in Rb group were administered Sgx at a dose greater than 4mg/kg (p = 0.21). Only one case in Rb group failed extubation attempt in operating theatre by hypermagnesemia. Lower neonatal body weight (pre-term infants) and high-dose Rb were independent risk factor of lower 1-min Activity (< 2 points) (respectively p=0.025, p<0.001). In term (37-41 weeks) subgroup analysis (Rb:49, Sx:30), high-dose Rb was also independent risk factor for 1-min muscle Activity (< 2 points, p=0.01). We hypothesize that this might reflect differences in sensitivity of acetylcholine receptor (γ-type). Conversely Sx were independent risk factor of neonatal intubation in operating theatre (p=0.01).

Chorioamnionitis, hypermagnesemia and time from incision to delivery (min) were not significant in Activity 1-min. However, chorioamnionitis was risk factor of lower Gtimace 1-min.

CONCLUSION :
Although the use of high-dose Rb was not associated with lower Apgar score, 1-min muscle Activity was lower compared with Sx in both univariate and multivariate analysis. The clinical significance of this is unclear, but high-dose Rb may lead to adverse event such as intubation for pre-term or lower weight infants.

Table 1. maternal characteristics	Sx (n = 56)	Rb (n = 95)	p value
Age	31.8 ± 6.0	31.4 ± 6.0	0.75
Weight (kg)	59.6 ± 11.5	61.3 ± 10.0	0.33
Gestational age (weeks)	34 ± 5.4	35.9 ± 4.5	0.28
NRFS	37 (66 %)	67 (71 %)	0.59
PIH	11 (20 %)	9 (10 %)	0.09
Mg (preoperative)	13 (23 %)	18 (19 %)	0.54
Chorioaminionitis (CAM)	2 (4 %)	13 (14 %)	0.051
pre-Term (< 37 weeks)	30 (54 %)	49 (52 %)	0.87

Table 2. marernal outcomes			
Incision to delivery time	2.8 ± 2.1	2.3 ± 1.4	0.21
Failed first maternal intubation	1/56	0/95	1
SpO2 desaturation ≥ 5%	8 (14 %)	10 (19 %)	0.6
Sugamadex > 4mg/kg	2 (4 %)	9 (9 %)	0.21
Failed extubation in OR	0/56	1/95	0.37
Neonatal outcomes			
Fetal body weight (g)	2244 ± 906	2350 ± 816	0.34
Acidosis < 7.10 (pH)	10 (18 %)	18 (19 %)	1
Intubation at OR	18 (32 %)	16 (17 %)	0.043
APGAR 1-min < 7 points	25 (45 %)	47 (49 %)	0.89
APGAR 5-min < 7 points	9 (16 %)	14 (15 %)	0.87
Activity 1-min < 2 points	26 (47 %)	62 (65 %)	0.027
Activity 5-min < 2 points	21 (38 %)	40 (42 %)	0.6
Grimace 1-min < 2 points	26 (46 %)	38 (40 %)	0.5
Grimace 5-min < 2 points	15 (27 %)	21 (22 %)	0.56

Table 3. the risk factors of the neonatal outcomes by multivariate analysis				
	All (n = 151)		Term (>37 wks, n = 79)	
Maternal outcomes	Risk factor	p value	Risk factor	p value
APGAR 1-min < 7	Low body weight	< 0.001	None	
	Nighttime c-sec	0.029		
APGAR 5-min < 7	Low body weight	< 0.001	None	
Activity 1-min < 2	Low body weight	0.001	High-dose Rb	0.01
	High-dose Rb	0.025	Mg	0.14
	Nighttime c-sec	0.14	Nighttime c-sec	0.3
	Mg	0.31		
	Delivery time	0.55		
	CAM	0.62		
Activity 5-min < 2	Low body weight	< 0.001	None	
Grimace 1-min < 2	Low body weight	< 0.001	None	
	CAM	0.007		
	Nighttime c-sec	0.039		
	Delivery time	0.35		
	Mg	0.74		
Grimace 5-min < 2	Low body weight	< 0.001	None	
Intubation at OR	Low body weight	< 0.001	Cannot be analyzed	
	Nighttime c-sec	0.001		
	Suxamethonium	0.01		
	Delivery time	0.55		

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