Effect of Rocuronium Versus Succinylcholine on Time to Neurosurgical Intervention in Patients with Intra-Cranial Hemorrhage

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Background

- Patients who have an intra-cranial hemorrhage with altered mental status may require emergent endotracheal intubation for airway protection.
- Neuromuscular blocking agents are typically required to facilitate this process.
- The neuromuscular blocking agents rocuronium and succinylcholine are commonly used to relax the jaw muscles so that the emergency physician can maneuver the endotracheal tube into the trachea. This process is called rapid sequence intubation (RSI)[1].
- There is debate regarding the optimal neuromuscular blocking agent in the setting of intra-cranial hemorrhage. Succinylcholine can increase intra-cranial pressure, which should be avoided in patients with intra-cranial hemorrhage.
- Some clinicians prefer using succinylcholine because it has a short duration of effect (5-7 min), compared to rocuronium (40-70 min)[2].

Objective

- To determine if neuromuscular blocker type used for RSI influences time to neurosurgical procedure.

Methods

Search Strategy & Study Selection

- A retrospective cohort study was conducted in an academic emergency department (ED) in the United States. The institution was designated as a level 1 trauma center.
- The study was approved by the associated University Institutional Review Board prior to data collection.
- A list of patients who received RSI in the ED between the periods 1 Jan 2014 to 1 October 2017, was generated from an RSI database maintained by the department of emergency medicine.
- Data was collected from electronic medical records and entered into Research Electronic Data Capture (REDCap).
- Information collected included patient demographics, medications used, timing of RSI, timing of neurosurgeon assessment, timing of subsequent neurosurgical procedures, and clinical information about the head injury.
- The primary outcome variable was the time from RSI to neurosurgical procedure.

Disclosure: Authors have nothing to disclose. For more information, contact Kianaz Kamangar at kamangar@pharmacy.arizona.edu

Methods (continued)

Data Analysis

- Continuous variables were reported as means with standard deviations or medians with interquartile ranges (IQR) as appropriate.
- Normally distributed continuous variables were compared between the groups using an unpaired Student's t-test.
- Non-normally distributed continuous variables were compared between the groups using the Wilcoxon rank-sum test.
- Categorical variables were reported as proportions and compared between the groups using the Fisher's exact test.
- A two-tailed alpha of 0.05 was considered to be statistically significant.
- All analyses were conducted using STATA 15 (College Station, Texas).

Patient Characteristics

Variable	Succinylcholine	Rocuronium	*p*-Value
Demographics and assessments			
Age (years), mean (SD)	45 (19)	52 (20)	0.275
Male, n (%)	31 (78)	10 (56)	0.122
Weight (kg), mean (SD)	82 (16)	82 (19)	0.992
Trauma patient, n (%)	36 (92)	18 (100)	0.544
Blunt trauma, n (%)	33 (92)	16 (89)	1.000
GCS prior to RSI, median (IQR)	8 (6-12)	7 (5-9)	0.171
GCS after RSI, median (IQR)	7 (5-9)	5 (3-7)	0.021
Hypotensive in ED, n (%)	6 (15)	1 (6)	0.417
Hypoxic in ED, n (%)	4 (10)	0 (0)	0.300
Type of hemorrhage			
Subarachnoid hemorrhage, n (%)	29 (73)	10 (56)	0.237
Subdural hemorrhage, n (%)	17 (43)	8 (44)	1.000
Epidural hemorrhage, n (%)	8 (20)	1 (6)	0.249
Intracerebral hemorrhage, n (%)	0 (0)	1 (6)	0.310
Intraventricular hemorrhage, n (%)	2 (5)	0 (0)	1.000
Injury characteristics			
Skull fracture, n (%)	26 (65)	8 (44)	0.162
Contusion, n (%)	17 (43)	9 (50)	0.776
Head bleed volume (ml), median (IQR)	1.1 (0.6-2.5)	2.3 (1.5-3.2)	0.075
Midline shift >5mm, n (%)	14 (35)	7 (39)	0.777
Cisterns compressed, n (%)	18 (45)	3 (17)	0.044
Medications and procedures			
Mannitol given in ED, n (%)	19 (48)	12 (67)	0.256
Hypertonic saline given in ED, n (%)	32 (82)	17 (94)	0.414
Craniotomy or craniectomy, n (%)	34 (85)	14 (78)	0.483
Ventriculostomy, n (%)	6 (15)	4 (18)	0.483

Table 1. Patient Characteristics. ED = Emergency Department; GCS = Glasgow Coma Scale; RSI = Rapid Sequence Intubation

Results

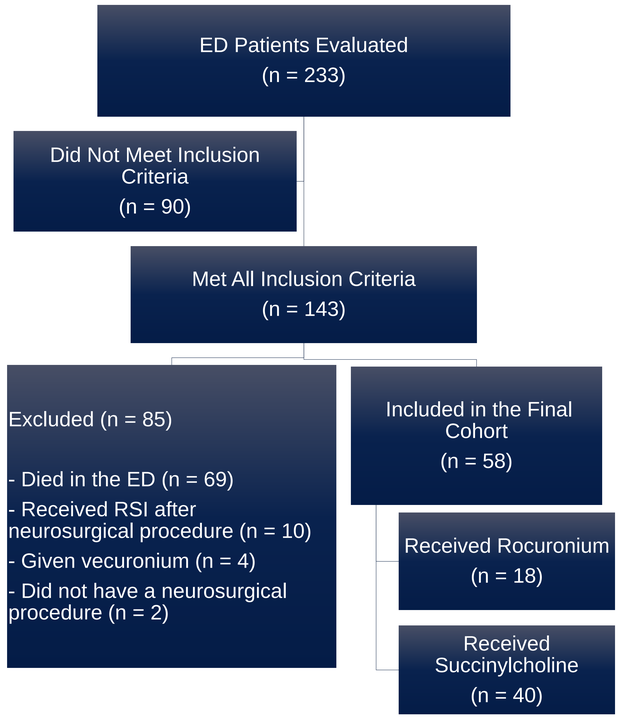

Figure 1. Patient Selection. ED = Emergency Department; RSI = Rapid Sequence Intubation

Characteristic	Rocuronium n= 18	Succinylcholine n= 40	*p*-Value
Received a benzodiazepine within 1-hour after RSI, n (%)	3 (17)	8 (20)	1.000
Time from ED presentation to RSI, median (IQR) [minutes]	46 (16-133)	18 (10-83)	0.187
Time from RSI to neurosurgeon assessment, median (IQR) [minutes]	123 (34-165)	64 (32-211)	0.950
Time from RSI to neurosurgical procedure, median (IQR) [minutes]	155 (84-226)	179 (93-390)	0.616

Table 2. Main Results. ED= Emergency Department; RSI= Rapid Sequence Intubation; IQR= Interquartile Range

Limitations

- This was a retrospective chart review and the gathered data relied on proper documentation of ED patients. Thus, inadequate documentation came in numerous forms.
- A possible explanation for the lapse in proper documentation and consistency may have resulted from the acuity of this patient population. The majority of patients who met inclusion criteria were critically ill upon presentation which required numerous interventions that could have diverted responsibilities of timely documentation and charting.
- We also struggled to enroll patients who received rocuronium. This is likely due to physician preference favoring succinylcholine among our neurosurgical group for patients who may require operative intervention.
- Another limitation resulting from this study's retrospective design is a lack of randomization.
- Due to the observational nature of this study's design, it is possible that additional factors lead the treating team to preferentially choose one neuromuscular blocker over another, which may result in selection bias; however, both groups had similar baseline median GCS scores, patterns of injury, and other baseline characteristics.

Discussion & Conclusions

- The primary finding of this study did not illustrate a statistically significant difference in time to neurosurgical procedure after RSI between patients who received rocuronium or succinylcholine, with the succinylcholine group having a greater time to neurosurgical procedure than the rocuronium group, at 179 (93-390) minutes vs. 155 (84-226) minutes (*p*= 0.616).
- The results of this study show that patients receiving longer-acting neuromuscular blocker agents like rocuronium during RSI do not encounter delays to neurosurgical procedures compared to patients receiving short-acting neuromuscular blocker agents like succinylcholine.
- As clinicians decide which neuromuscular blocking agent would be preferred in these circumstances, rocuronium should not be avoided solely for its longer duration of effect.
- Although this study was not adequately powered, the results indicate a need for further research to determine if longer-acting neuromuscular blocker agents like rocuronium used for RSI cause delays to neurosurgical procedures.

References

1. Kilber, E., Jarrell, D.H., Sakles, J.C., Edwards, C., Patanwala, A.E. Analgosedative interventions after rapid sequence intubation with rocuronium in the emergency department. *Emerg. Med. J.* 2017;36:1129-1133
2. Johnson, E.G., Meier, A., Shirakbari, A., Weant, K., Baker Justice, S. Impact of rocuronium and succinylcholine on sedation initiation after rapid sequence intubation. *Emerg. Med. J.* 2015;49:43–49
3. Watt, J.M., Amini, A., Traylor, B.R., Amini, R., Sakles, J.C., Patanwala, A.E. Effect of paralytic type on time to post-intubation sedative use in the emergency department. *Emerg. Med. J.* 2013;30:893–895