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Effects of mechanical insufflation-exsufflation in preventing tracheostomy for acute cervical spinal cord injury.

Yoshiaki Terao[1], Makito Oji[1], Natsuko Oji[1], Shigehiko Urabe[1], Hiroki Iwanaga[1], Yuki Soejima[1], Hiroshi Aoki[1], Tetsuya Hara[2].
1, Department of Anesthesia, Nagasaki Rosai Hospital, Sasebo, Japan.
2, Department of Anesthesiology and Intensive Care Medicine, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan.

Background: Although mechanical insufflation-exsufflation (MI-E) has been described as an efficient technique in patients with chronic muscle weakness complicated with ineffective cough and secretion retention, there are few studies in patients with acute cervical spinal cord injury (ACSCI) in intensive care unit [1,2]. Cochrane review [3] showed that cough augmentation techniques used with MI-E when used critically ill patients appeared to result in few adverse events. Moreover, the role of cough augmentation to prevent post-extubation respiratory failure is unclear [4]. The purpose of this retrospective study was to assess the efficacy of MI-E in preventing tracheostomy for ACSCI patients.
Methods: The Institutional Research Committee approves this retrospective study and to waive informed consent because study procedure was routine examination in ACSCI patients. This study was conducted in Nagasaki Rosai Hospital from March 2016 to April 2019 (pre MI-E period) and May 2019 to June 2023 (post MI-E period). We started MI-E from March 2019. ACSCI patients with Frankel A or B treated in ICU were included. We included 10 patients (C group) with conventional therapy in pre MI-E period and 11 patients (M group) with conventional therapy combined with MI-E in post MI-E period. The patients were intubated for respiratory insufficiency or general anesthesia, if necessary. The intubated patients under mechanical ventilation were treated with standard medical therapy including physical therapy and bronchoscopy every day. The patients were extubated after conventional spontaneous breathing trial. The patients were reintubated after extubation, if necessary. The patients underwent tracheostomy in reintubated patients. The patients without intubation and the extubated patients were treated with MI-E (4 sessions every day) with the Cough Assist (Phillips Respironics, USA) (figure 1) through the face mask with pressures set at 20 cm H_2O for insufflation and -20 cm H_2O for exsufflation pressure, as soon as, possible, in M group. An insufflation/exsufflation time ratio of 2:2 seconds and pause of 2 seconds between each cycle were used five cycles were applied in every session. Tracheostomy rate was considered as the primary end point.
The results are expressed as median (IQR). Statistical analyses were performed by Mann-Whitney *U* test or Fisher's exact test. A *p*-value < 0.05 was considered statistically significant.
Results: There were not significant differences between the two groups in patient's characteristics in table 1. The incidence of tracheostomy in M group was less than that in C group (2/11 vs 7/10) in table 2.
Conclusion: This retrospective study suggested that MI-E might be effective in preventing tracheostomy in ACSCI patients. However, future multicenter randomized controlled trials with a sufficient sample size to confirm the efficacy of MI-E in ACSCI patients.

References:
1, Respir Care. 2016; 61: 1360-1368.
2, Spinal Cord. 2017; 55: 559-565.
3, Cochrane Database Syst Rev. 2017 ;1
4, Respir Care. 2022; 67: 1043-1057.

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Competing Interests: We have no competing interests.

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Table 1. Patient characteristics

Group	M group (11)	C group (10)	p
Age (yr)	69 (54, 81)	72 (68, 77)	0.86
Height (cm)	163 (157, 165)	162 (158, 165)	0.89
Weight (kg)	55 (50, 66)	62 (55, 70)	0.19
BMI	22.5 (19.8, 24.3)	24.2 (20.0, 26.0)	0.45
Male (n)	9/11	9/10	0.99
Injury level	5 (4, 5)	5 (4, 6)	0.89
Frankel A (n)	3/11	5/10	0.39
Operation (n)	8/11	5/10	0.39
Etiology (n)	Fall: 4	Fall: 4	
	Fall down: 4	Fall down: 3	
	Blow: 2	Accident: 2	
	Infection: 1	Blow:1	

M group, Mechanical insufflation-exsufflation group; C group, Control group;

Table 2. Selective variables

Group	M group (11)	C group (10)	p
Initial intubation (n)	2/11	2/11	0.99
Initial ventilation day (day)	5 (4, 10)	5 (2, 16)	0.79
Reintubation (n)	2/11	7/10	0.03
Tracheostomy (n)	2/11	7/10	0.03
Total ventilation day (day)	7 (4,13)	51 (2, 82)	0.31
ICU day (day)	21 (11, 27)	19 (10, 30)	0.80
Hospital day (day)	71 (59, 74)	67 (53, 110)	0.80
Death at discharge (n)	0/11	3/11	0.09

M group, Mechanical insufflation-exsufflation group; C group, Control group;

Figure 1. Cough Assist device