

Successful Weaning of Ventilator in Cervical Cord Injured in Chiang Mai University Hospital, Chiang Mai, Thailand

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Study design: Retrospective study

Objectives: To study outcome of weaning protocol and predicting factors that affect success in SCI ventilator weaning.

Setting: Spinal Cord Injury Critical Care Unit, Chiang Mai University Hospital, Chiang Mai, Thailand

Method: Forty-two SCI patients with ventilators who were admitted at Spinal Cord Injury Critical Care Unit, Chiang Mai University Hospital were included in this retrospective study. Data were collected from 2013 to 2016, using hospital database. The study was conducted under approval from the Institutional Review Board of Faculty of Medicine, Chiang Mai University. Univariate analysis was used to identify the factors related to weaning success. Multivariate analysis was used to investigate the independent factors providing significant association with successful weaning.

Results: Among 42 spinal cord injury patients with ventilators, 37 cases (88.09%) achieved successful weaning. Normal level of consciousness (OR=11.1, 95%; CI 3.4, 59.55), normal chest-film (OR=5.8, 95%; CI 1.2, 59.4), normal vital signs (OR=25.5 95% CI 1.42,137.5), and normal hemoglobin/hematocrit (OR=19.8, 95%; CI 1.17, 106.8) were the factors related to successful rate of ventilator weaning.

Conclusion: The success rate of ventilator weaning of this study was 88.09 %. There were several factors associated with successful ventilator weaning. In our practice, the patients' consciousness level, vital signs, chest film, and hemoglobin/hematocrit should all be normal and monitored during the weaning processes.

Keywords: Spinal cord injury, outcome of weaning mechanical ventilator, predicting factors

INTRODUCTION:

Respiratory complications are a catastrophic problem in spinal cord injured (SCI) patients and a major cause of morbidity and mortality. Spinal cord injury above the level of phrenic motor neurons (C3, 4 and 5)¹ cause diaphragm and expiratory muscle paralysis, and lower levels of cervical SCI cause accessory inspiratory and expiratory muscle paralysis. The respiration may overwork and rapidly fatigue muscles leading to inspiratory failure and inadequate clearance of the secretions related to ineffective coughing. When the vital capacity (VC) is less than 15 ml/kg ideal body weight, there will be increased oxygen consumption, increased respiratory rate, rising PCO₂, and diminished breath sounds in the lung fields.² Respiratory impairment will occur and usually will end up with intubation and mechanical ventilator support in the early stages in an SCI Critical Care Unit or Intensive Care Unit. Several risk factors regarding respiratory complications, quality of life, financial burden, and care giver burden are associated with long-term use of ventilators making weaning from ventilator a high priority.

The weaning program does not necessary to be a rapid process in SCI patients if they present initial problems with secretion, infection and aspiration. If it appears the patient going to be ventilator dependent then tracheostomy should be considered. The weaning program should be

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started as soon as possible once the weaning criteria of good lung condition, stable vital signs, medically stable for at least 24 hrs, appropriate nutritional status, and initial VC at least 10 ml/kg ideal body weight.

In the developed countries, SCI patients that could not wean ventilator are usually discharged with portable ventilators or referred to home health care. But in Thailand SCI patients cannot afford the high cost of mobile ventilators, and there is no home health care.

Before 1996, Chiang Mai University Hospital had neither a specialized SCI weaning protocol nor home ventilators for SCI patients. At that time, an SCI critical care setting would be required for prolong mechanical ventilator use. However, there was a growing body of SCI weaning protocols at our hospital. The first step was to begin with a ventilator muscle training (VMT) program and then to try weaning with an informal program depending on the patients' condition and their ability. This provided initial data and management experience. From these lessons learned, in 2001 a weaning program began to be developed which included a VMT protocol, a breathing exercise program, nutritional management, psychological support, and put respiratory management skills for nurses. After the protocol, the success rate of weaning ventilator increased from 76.70% to 90.47%, and ventilator days decreased from 79 days to 32 days in 5 years.

METHODS/MATERIALS

Design

After approval from the Institutional Review Board of Faculty of Medicine, Chiang Mai University, a retrospective review of data was collected from 2013 to 2016, by using hospital database was performed. Weaning outcome data and Predicting factors data evaluated consisted of demographic and prior health information, including any history of diabetes mellitus, hypertension, the American Spinal Injury Association (ASIA) score was used to quantify the severity of paralysis, co-morbid, lung disease, chest trauma, smoking, conscious, fever, CXR, Cardio vascular status, electrolyte, Hb, Hct, VMT, Nutritional status, Psychological status, abdominal condition and tracheostomy.

Participants

Forty-two acute SCI patients admitted between January 2012 and December 2015 who were used ventilator in Spinal Cord Injury Critical Care Unit were included in this retrospective study.

Statistical analysis

Descriptive statistic was used to analysis weaning outcome, the Univariate analysis was used to identify the factors related to weaning success. Multivariate analysis was used to investigate the independent factors providing significant association with weaning successful

RESULTS

Table 1 Demographic data (n = 42)

Variable	Success		Failure	
	number	percent	number	percent
Gender				
Male	35	83.3	4	9.5
Female	2	4.7	1	2.5
Age				
< 60 years	28	66.6	4	9.5
> 60 years	9	21.4	1	2.5

Level of injury	number	percent	number	percent
C1	2	4.7	0	0
C2	2	4.7	2	4.7
C3	5	11.9	0	0
C4	19	45.2	1	2.5
C5	4	9.5	1	2.5
C6	3	7.1	1	2.5
C7	2	4.7	0	0
AIS Score				
A	15	35.7	4	9.5
B	8	19.0	0	0
C	5	11.9	0	0
D	9	21.4	1	2.5
Comorbidity	17	40.5	3	7.1
lung disease	13	30.9	2	4.7
chest trauma	4	9.5	0	9.5

Table 1 summarizes the demographic data of participants including gender, age, level of injury, ASIA score, comorbid, lung disease and chest trauma. 83.3% of participants are male that success in weaning ventilator, 66.6% are adults, most of them had level of Spinal Cord Injury C4 with ASIA score group A, 40.5% had comorbidity and 30.9% had lung disease.

Table 2 Predicting factors

Factors	OR	95% CI
Level of consciousness	11.1	3.4 - 59.55
Normal chest-film	5.8	1.2 – 59.4
Normal vital sign	25.5	1.42 – 137.5
Normal hemoglobin/hematocrit	19.8	1.17 – 106.8

Table 2 Among 42 Spinal Cord Injury patients with ventilator, there were 37 cases (88.09%) achieved successful weaning. Among 12 predicting factors in this study we founded 4 factors that showed statistic significant related to successful rate of ventilator weaning. Level of consciousness (OR=11.1 95%CI 3.4,59.55), normal chest- film (OR=5.8 95%CI 1.2,59.4), normal vital sign (OR=25.5 95%CI 1.42,137.5), and normal hemoglobin/hematocrit (OR=19.8 95%CI 1.17,106.8).

DISCUSSION

Cervical Cord Injury often lead to restrictive respiratory changes. Patients with severely impaired vital capacity may require assisted ventilation. Proceed with intubation under controlled circumstances rather than waiting until the condition becomes an emergency. However, long term ventilator could make many complication and leading high cost and prolong length of stays. Weaning should start as soon as possible.

Among 12 predicting factors in this study, chest film was the one factors that health care provider must pay attention in SCI patients. Good chest film can find in SCI patient who has continuous physical therapy. In SCI Unit must has full time physical therapist or specialist SCI nurses who have a skill to clear lung. Orthopedist must concern to evaluate laboratory and chest

film as possible. In another way, this study has limitations inherent to all retrospective studies of predicting factors. We did not compare the difference of successfully and unsuccessfully in a big group of participants that can guarantee the best benefit outcome of weaning protocol. We had a limited to find the clearly data before 2011 because of some data record system had change at that time, made this study got small group of participants.

In conclusion, our data here confirm that many SCI patients with respiratory failure can successfully weaning of ventilator during their acute hospitalization. The 4 independent predicting factors are the key success that confirm the benefit of our protocol. Multidisciplinary team should be put 4 factors in the screening protocol for pre-weaning in SCI patients.

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