Application of Burn's wean assessment program on the duration of mechanical ventilation among patients in intensive care units: A clinical trial

Ahmadreza Yazdannik, Fatemeh Salmani[1], Alireza Irajpour, Saeid Abbasi[2]

ABSTRACT

Background: Weaning decision for the patients on a mechanical ventilation (MV) device is often made based on personal judgments and experiences, which results in longer MV length of stay and higher costs. Therefore, the present study aimed to the effect of application of Burn's wean assessment program on MV length of stay among the patients hospitalized in intensive care units (ICUs).

Materials and Methods: This is a clinical trial in which 50 patients connected to mechanical ventilators for more than 48 h were selected through convenient sampling and were randomly divided into two groups of 25 subjects. Burn's wean assessment program was employed in study group, while weaning was assessed by a physician in control group. The findings were analyzed by descriptive (frequency distribution, mean and SD) and inferential (independent t-test, Chi-square, Fisher's exact test, and Mann Whitney) statistical tests.

Results: The findings showed that length of MV was 134.2 (20.5) h which was significantly less than the control ($P = 0.03$).

Conclusion: The results showed that application of Burn's wean assessment by the nurses to assess patients' readiness for weaning from the ventilator is a safe method in day time and shortens the length of MV in ICUs compared to the routine methods.

Key words: Burn's wean assessment program, intensive care unit, Iran, mechanical ventilation, nursing, ventilator weaning

INTRODUCTION

Mechanical ventilation (MV) is one of the most routine prescribed medical treatments in intensive care units (ICUs).[1] This is an integrated part of a treatment in ICU which most of the critical patients or those with complications need.[2] MV is needed in 90% of the adult critical patients in ICUs.[3] Ventilator as an oxygenation and ventilation support in patients who cannot have natural respiration due to any reasons has saved patients' live.[4] It should be noticed that each phenomenon may have disadvantages despite its numerous advantages. MV can have negative effects on patients' cardiovascular respiratory, digestive, and musculoskeletal systems, fluid and electrolytes condition as well as psychological status.[5] Long lasting MV can enhance health care costs.[3]

Since patients' weaning from MV is an important stage in treatment in ICU, patients' readiness to be weaned from MV, and management of the weaning process is very crucial.[1] Since MV leads to numerous complications and inappropriate weaning of the patients from ventilator resulting in respiratory distress, the patients should be separated from assisted ventilation as soon as they are able to have spontaneous respiration.[6,7]

Experienced nurses are the key elements in ICUs who are decisive in emergency cases and constant to administrate various nursing processes.[8] One of the important roles, of nurses in ICUs is to diagnose patients' readiness for weaning as the initial step of patients' weaning from MV.[9]

A study has shown that decision making for patients' weaning from MV is often based on mental judgments and personal experience which leads to longer length of stay on MV and higher patients' costs.[1] Researchers have shown that clinical decision making to wean the patients from MV in ICUs is often based on physician's experience or judgment, and assessment of some parameters which

Departmant of Critical Care Nursing, Faculty Nursing and Midwifery, [1]Nursing Education, Faculty Nursing and Midwifery, Nursing and Midwifery Care Research Centre, [2]Department of Anesthesiology and Intensive Care, Faculty Member of Medical School, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence: Ahmadreza Yazdannik, PhD, Assistant professor, Faculty Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: yazdannik@nm.mui.ac.ir

put the patients in danger of device dependency, longer ventilation, and higher costs. Former studies have also shown that nurses can efficiently prepare the patients for weaning from MV device in a safe way and through use of weaning protocols and tools.[1,7]

There are various tools to measure patients' readiness to be separated from MV device. These tools evaluate patients' readiness for weaning and are reported to cause patients' on time weaning from MV device.[10] The studies conducted in Iran have shown that in most of the ICUs, patients' weaning from MV device is either based on personal experience and assessment of some parameters or just a physician's order so that no specific tool or protocol is used to assess patients' readiness for weaning.[5,11] One of the tools used for assessing patients' readiness for weaning is Burn's[1] wean assessment.[12] This tool systematically and holistic assesses patients' weaning from MV device. This tool is user friendly and its parameters are assessed in 10 min.[13,14] In Burn's study, the efficiency of this tool in ICU has been investigated for 5 years and it was shown that its application has resulted in successful weaning of the patients in 88% of the patients with MV for more than 72 h.[15] Epstein and peerless showed that MV length of stay by Burn's wean assessment tool significantly decreased in study group.[16] Since the last stage before patients' weaning from MV is very important and necessitates 24 h patients' supervision, the nurses are the only persons spending most of the time with the patients who can assess them and report to other members of treatment team.[14] With regard to the importance of numerous advantages of ICU scoring systems in developed countries, many studies have been conducted on these systems and have led to their practical application.

Since related conducted researches in Iran are very few,[5,11] and there is no specific protocol to assess patients' readiness for weaning from MV leading to weaning failure, higher MV length, patients' longer stay in ICU, more ICU beds occupation, and longer wait time of critical patients to be admitted in ICUs.[11] The researcher conducted a research in order to suggest a helpful strategy for nurses' interaction in weaning process, and to lower possible complications of MV in ICUs.

MATERIALS AND METHODS

This is a clinical trial conducted on 50 patients connected to MV for more than 48 h who had referred to Alzahra hospital affiliated to Isfahan University of Medical Sciences in 2011. The subjects were selected by convenient sampling from July to Nov 2011 and then were randomly divided into study and control groups by selective method through minimization software.[17] After getting permission from the head of Alzahra hospital and head nurses of ICUs, informed consent form was filled by the patients or their family members who had been already explained about inclusion criteria.

The data were collected by (1) a questionnaire on demographic characteristics, and patients' clinical condition and MV, and (2) Burn's wean assessment program. The latter checklist, suggested by Burn *et al*. in 1990, includes 26 items of which 12 are for general measurement and 14 for patients' respiratory function. The questions are in Likert scale with triple options. Its total score is 26, and when the patients are scored over 17, they are ready for weaning so that the process of weaning can start.[18] Burn's wean assessment program is a checklist employed in numerous studies.[14,16,18]

In the present study, content validity was confirmed by four ICU head nurses and two anesthesiologists for its validity. Its reliability was confirmed by alpha Crobach of 85%. In another study, its reliability had been reported 92%.[14]

The patients on MV for more than 48 h, with no history of chronic respiratory, cardiovascular, and mental diseases who had either voluntarily liked or whose family members liked them to attend the study joined the research. Exclusion criteria were patients' death, a surgery, transfer to other wards and spontaneous removal of tracheal tube during the study. Burn's wean assessment parameters were assessed by the researcher and trained nurses in all three working shifts in the study group. Whenever, the patients had scored over 17, the attending anesthesiologist would be informed about their weaning readiness and weaning would run. In control group, based on routine care program of ICU, the physician would assess patients' readiness for weaning. At the end, the length of MV was calculated and compared in both groups.

The data were analyzed by descriptive and inferential statistical tests through SPSS ver 17. Independent *t*-test, Chi-square, Fisher's exact test, and Mann Whitney test were employed to compare demographic variables and the studied factors.

RESULTS

The findings showed that both groups were identical concerning demographic characteristics [Table 1], cause of hospitalization, mode of MV and GCS [Table 2], and there was no significant difference between the groups. Independent *t*-test showed that mean length of MV was 134.2 (20.5) h in study group, which was significantly lower than control 263.2 (55.1) h, ($P = 0.03$).

Table 1: Comparison of frequency distribution and mean of demographic characteristics in two groups of study and control

Demographic characteristics	Group				P-value
	Study		Control		
	No	%	No	%	
Gender					
Male	16	64	19	76	0.35
Female	9	36	6	24	
Education					
Illiterate	6	24	6	24	0.20
Middle school	12	48	8	32	
High school over	7	28	11	44	
Age					
Mean	45.6		47.6		0.74
SD	21.2		21.2		

Table 2: Comparison of frequency distribution and mean of patients' clinical condition in two groups of study and control

Patients' clinical condition	Group				P-value
	Study		Control		
	No	%	No	%	
Device mode at the time of connection to the patients					
SIMV	19	76	22	88	0.23
CAPA	6	24	3	12	
Cause of hospitalization					
Multiple trauma	6	24	8	32	0.31
Surgery	15	60	9	36	
Head injury	1	4	5	20	
Internal injury	2	8	2	8	
Neuromuscular injury	1	4	1	4	
GCS					
Mean	14.2		14.6		0.20
SD	1.5		0.86		

DISCUSSION

Since the process of patients' weaning from MV device takes 56-92% of total MV length, assessing the patients' readiness and management of weaning process seem important.[1]

The obtained results showed that patients' assessment for weaning by a nurse and through Burn's tool significantly lowered length of MV in patients undergoing MV for more than 48 h. Burn in his study in 2010 also showed that holistic of the patient by nurses through Burn's wean assessment program significantly diminished the length of MV. He also indicated that 88% of the patients who were on MV for more than 48 h were successfully weaned.[15] Tonnelier assessed that the effects of nursing strategies in direct participation for patients' weaning from MV device were positive and reported that a nurse can conduct weaning assessment leading to shorter hospitalization and on time weaning from MV device.[7] In another study, on 300 hospitalized patients in ICU, parameters of patients' weaning from the ventilator were assessed in day time by nurses and it was shown that patients' need to be in ventilator as well as their hospitalization time had decreased.[19] Dobuse showed that use of a daily checklist in assessing traumatized patients' progress ICU wards lowers patients' hospitalization in ICU.[20] Chaiwat's study on 100 surgical patients needing MV for more than 24 h showed that assessing patients' readiness for weaning by nurses speeds up patients' weaning from MV.[1]

There are controversial results in conducted studies. Krishnan in a study on strategies of patients' weaning from MV, conducted based on protocol, showed no significant difference between two groups concerning successful weaning from the MV device, length of stay on MV, length of hospitalization, and level of reconnection to the device.

They concluded that no protocol may be needed in ICUs where a specific physician exists.[21] Randolph in a study on 182 patients on MV for more than 24 h reported that patients' wean assessment by nurses had not lowered the length of stay on MV device, and there was no significant difference in study and control groups.[22] Namen studied 100 neurosurgery patients on MV and showed that measurement of weaning parameters by nurses during the working day had not diminished length of stay on MV; there was no difference in length of stay on MV in both groups.[23]

The reason for existing controversy can be due to patients' clinical condition, and type and times of patients' assessment during the day. The limitations in the present study were inadequate accessible subjects, long time needed for sampling and subjects' drop due to high mortality in ICUs.

CONCLUSION

The results showed that assessment of patients' wean from MV device by nurses through Burn's wean assessment program lowers length of stay on MV resulting in shorter hospitalization in ICU and giving chance to the patients in immediate need for these wards.

ACKNOWLEDGMENTS

REFERENCES

1. Chaiwat O, Sarima N, Niyompanitpattana K, Komoltri C,

Udomphorn Y, Kongsayreepong S. Protocol-directed vs. physician-directed weaning from ventilator in intra-abdominal surgical patients. J Med Assoc Thai 2010;93:930-6.

2. Radhakrishnan M, Indranil G, Dash HH. Evaluation of an indigenous ventilator for weaning in intensive care unit. J Anesthesiol 2007;23:297-2.

3. McLean SE, Jensen LA, Schroeder DG, Gibney NR, Skjodt NM. Improving adherence to a mechanical ventilation weaning protocol critically ill adults: Outcomes after an implementation program. Am J Crit Care 2006;15:299-9.

4. Mohammadi GH, Ebrahimian AA, Mahmodi H. Measure nurses' knowledge intensive care unit. J Crit Care Nurs 2009;2:41-6.

5. Hossaini M, Ramezani J. Assessment of the APACHE- 2 scoring system in predicting the results of weaning of mechanical ventilation. J Knowl Health 2007;2:2-7.

6. Soran A, Chelluri L, Lee KK, Tisherman SA. Outcome and quality of life of patients with acute pancreatitis requiring intensive care. J Surg Res 2000;91:89-94.

7. Tonnelier JM, Prat G, Le Gal G, Gut-Gobert C, Renault A, Boles JM, *et al*. Impact of a nurses' protocol-directed weaning procedure on outcomes in patients undergoing mechanical ventilation for longer than 48 hours: A prospective cohort study with a matched historical control group. Crit Care 2005;9:83-9.

8. Cowan DT, Norman I, Coopamah VP. Competence in nursing practice: A controversial concept – a focused review of literature. Nurse Educ Today 2005;25:355-62.

9. Monaco F, Drummond GB, Ramsay P, Servillo G, Walsh TS. Do simple ventilation and gas exchange measurements predict early successful weaning from respiratory support in unselected general intensive care patients? Br J Anaesth 2010;105:326-33.

10. Chen YC, Hsu HH, Kao KC, Fang JT, Huang CC. Outcomes and APACHE II predictions for critically ill patients with acute renal failure requiring dialysis. Ren Fail 2001;23:61-70.

11. Jalalian HR, Aslani J, Panahi U. Factors influencing the weaning of duration from mechanical ventilation in the intensive care unit. Kosar Med J 2009;14:163-7.

12. Truwit JD. Viewpoints to liberation from mechanical ventilation. Chest 2003;123:1779-80.

13. Knebel AR, Shekleton ME, Burns S, Clochesy JM, Hanneman SK, Ingersoll GL. Weaning from mechanical ventilation: Concept development. Am J Crit Care 1994;3:416-20.

14. Plang-wan R. The effects providing information and instilling reassurance on uncertainty in weaning from mechanical ventilation. Masters thesis of nursing science (adult nursing), Faculty of Graduate studies. Thailand: Mahidol University; 2004.

15. Burns SM, Fisher C, Earven Tribble SS, Lewis R, Merrel P, Conaway MR, *et al*. Multifactor clinical score and outcome of mechanical ventilation weaning trials: Burns wean assessment program. Am J Crit Care 2010;19:431-9.

16. Epstein CD, Peerless JR. Weaning readiness and fluid balance in older critically ill surgical patients. Am J Crit Care 2006;15:54-64.

17. Scott NW, McPherson GC, Ramsay CR, Campbell MK. The method of minimization for allocation to clinical trials. A review. Control Clin Trials 2002;23:662-74.

18. Burns S. Burns Weaning Assessment Program. Am J Crit Care Med 1994;3:12-3.

19. Ely EW, Meade MO, Haponik EF, Kollef MH, Cook DJ, Guyatt GH, *et al*. Practice guidelines professionals: Evidence-based clinical driven by nonphysician health-care mechanical ventilator weaning protocols. Chest 2001;120;454-63.

20. DuBose J, Teixeira P, Inaba K, Lam L, Talving P, Putty B, *et al*. Measurable outcomes of quality improvement using a daily quality rounds checklist: One-year analysis in a trauma intensive care unit with sustained ventilator-associated pneumonia reduction. J Trauma 2010;69:855-60.

21. Krishnan JA, Moore D, Robeson C, Rand CS, Fessler HE. A prospective, controlled trial of a protocol-based strategy to discontinue mechanical ventilation. Am J Respir Crit Care Med 2004;169:673-8.

22. Randolph AG, Wypij D, Venkataraman ST, Hanson JH, Gedeit RG, Meert KL, *et al*. Effect of mechanical ventilator weaning protocols on respiratory outcomes in infants and children. JAMA 2002;288:2561-8.

23. Namen A, Ely E, Tatter S, Case D, Lucia M, Smith A, *et al*. Predictors of successful extubation in neurosurgical patients. Am J Respir Crit Care Med 2001;163:658-64.