POST-ICU MECHANICAL VENTILATION: OUTCOMES OF PILOT TESTING OF THE REVISED THERAPIST-IMPLEMENTED PATIENT-SPECIFIC (TIPS©) WEANING PROTOCOL

Douglas Vela, RCP; Meg Hassenpflug, MS, RD; Jillisa Steckart, MEd, PsyD; Alex Villarruz, MT, CPHQ, MHA; David R. Nelson, MD; Scott A. Sasse, MD

Barlow Respiratory Hospital and Research Center, Los Angeles, CA; VA-GLAHS, Los Angeles, CA

INTRODUCTION

Barlow Respiratory Hospital (BRH) is a 105-bed long-term acute care (LTAC) hospital network that serves as a regional weaning center, accepting chronically critically ill (CCI) patients transferred from ICUs of hospitals in southern California. Patients have been weaned using the Therapist-Implemented Patient-Specific (TIPS©) protocol since 1998.[1] The protocol was reviewed and revised in an effort to decrease time (days) to wean from prolonged mechanical ventilation (PMV). Herein we report weaning outcomes of pilot testing after the implementation of our most recent revision of the protocol compared to outcomes of the previous calendar year.

METHODS

In 2012 an interdisciplinary task force was formed to review the existing protocol and seek opportunities for performance improvement. A literature review was performed to update the evidence base of ICU and LTAC weaning protocols/practices, stability and weaning parameters, and ventilator modes. Input was solicited from staff respiratory care practitioners (RCPs), pulmonologists, and other key stakeholders. Protocol revisions were drafted, circulated, and discussed; expert opinion was utilized for decisions lacking a true evidence base. Electronic health record (EHR) documentation was updated to reflect protocol revisions and provide data for compliance monitoring. After policy approval and training of all staff, the revised protocol was applied to patients admitted beginning 3/3/2014. Outcomes (weaned, ventilator-dependent, died) were scored at BRH discharge for both cohorts; weaned was defined as patient free of invasive mechanical ventilation at least one full calendar day prior to day of discharge. Time to wean (days) was tallied from day of admission through last day of ventilator support.

Patient Admission Characteristics, Weaning Outcomes, and Time to Wean: Comparison Analysis of Two Time Periods

	2013 (n=297)	2014 (n=101)	p
Characteristics on Admission:			
Age, years	74 [17-100]	73 [26-97]	
Gender, male	56%	63%	
Ethnicity:			
Caucasian	64%	63%	
Non-Caucasian	36%	37%	
LOS transferring facility, days	23 [1-138]	21 [2-68]	
Medicare	78%	73%	
Pre-morbid location, home	65%	63%	
Pre-morbid function, good	59%	54%	
APACHE® III APS	41.5 [9 – 98]	47.0 [19 – 85]	
Hematocrit (%)	29.6 ± .26	28.9 ± .68	
Serum albumin (g/dl)	2.3 ± .04	2.4 ± 0.08	
BUN (mg/dl)	36.6 ± 1.7	38.1 ± 4.0	
Serum creatinine (mg/dl)	1.2 ± .08	1.2 ± 0.18	
Pressure ulcer ≥ stage II	156 (52.5%)	69 (68.4%)	.02
Weaning Outcomes:			
Weaned	164 (55%)	58 (57%)	
Ventilator-dependent	108 (36%)	33 (33%)	
Died	25 (9%)	10 (10%)	
Time to Wean, days	16.1 [1-102]	14.0 [4-36]	.04
Length of Stay, days	34.0 [3 - 294]	32.0 [4 - 107]	.05

BARLOW "TIPS©" PROTOCOL

09/13 Ver 22

For patient admitted on SIMV/PS:
If SIMV > 10 or PSV ≥ 20 continue current settings.
If SIMV ≤ 10 and PSV ≤ 20, no change, but begin TIPS if patient's PSV supported breaths are <9 ml/kg, change to the TIPS step with the same SIMV setting, ***OR***
If patient's PSV supported breaths are >9ml/kg, SIMV may be reduced to 4 in one step, and PSV should be reduced until spontaneous breaths approximate 8-9 ml/kg.

DAILY EVALUATION (DE)
Do NOT proceed to Weaning Assessment and Weaning if any ONE of the following is present:
1. Hemodynamic instability:
   Vasopressor infusion used to stabilize blood pressure
   Systolic blood pressure < 90 mmHg
   Pulse < 50 or > 130 bpm
2. Temp >100.4
3. FiO2 > 0.5 or PEEP > 8
4. Other (record reason)

If patient fails Daily Evaluation record reason in EMR. When patient passes Daily Evaluation, proceed to Weaning Assessment.

WEANING ASSESSMENT (WA)
Do NOT proceed to Weaning if any ONE of the following is present:
1. Respiratory rate > 35
2. Tidal volume < 0.25 L
3. O2 saturation < 90%
4. Pulse > 130 or increase from baseline > 20
5. Prominent accessory muscle use

Record data in EMR. When patient passes the Weaning Assessment, proceed to Weaning.

WEANING
Perform the RSBI (see RSBI policy) daily for patients on steps 1-9. Record as per RSBI policy.
After the ventilator change has been made per the protocol step, repeat the WA at 5 minute interval and record parameters in the EMR.
If the patient fails a step at any time, contact Respiratory Care Supervisor or Lead Tech then chart WA and record time; reverse steps one at a time until patient is comfortable. Notify MD if patient is reversed ≥ 3 steps.
If a patient fails to progress to the next TIPS step for three consecutive days, report to MD.

TIPS WEANING STEPS:

- Do RSBI after successful WA steps 1-9; if RSBI<100 proceed to Step 10.
- Up to 3 steps per day at q 4hr intervals
- Record updated values for DE, WA, and WA at the 5 minute interval for each step advance attempt each day.

Reduction of SIMV:
1. A/C to SIMV 10 / PS 20
2. SIMV 8 / PS 20
3. SIMV 6 / PS 20
4. SIMV 4 / PS 20

Reduction of PSV:
5. SIMV 4 / PS 18
6. SIMV 4 / PS 16
7. SIMV 4 / PS 14
8. SIMV 4 / PS 12
9. SIMV 4 / PS 10

Self-Breathing Trials (SBT)
- Notify ICU monitor technician.
- Return to SIMV 4, PSV 10 at end of trial.
- If at the end of the SBT patient is comfortable and wishes to continue, trial may be continued one more step. Up to 2 steps per day.
- Use cool aerosol for SBT to prevent drying and irritation of the respiratory tract and to facilitate secretion removal.

10. 1 hour
11. 2 hours

❑ ABG - result to MD

12. 4 hours
13. 6 hours
14. 8 hours
15. 10 hours
16. 12 hours
17. 16 hours
18. 20 hours
19. 24 hours

RSBI Instruction :
1. Silence Alarm. Set PEEP = 0; mode = CPAP; PS level = 0.
2. Observe patient; record VE and RR at 1'15". If distress develops, note VE and RR immediately and return to prior ventilator settings, note duration of trial. RSBI = $(RR)^2$ / VE

RESULTS

Two key protocol revisions were realized to "accelerate" weaning during steps 1-9: 1) daily rapid shallow breathing index (RSBI) measurements to assess for earliest opportunity to advance to self-breathing trials[2], and 2) up to three daily reassessment opportunities to advance multiple steps in the protocol. From 3/3/2014 through 9/30/2014, 101 CCI patients admitted for weaning and treated with the revised protocol reached outcome. Results of pilot testing are compared to 297 CCI patients discharged in 2013 treated by the same physicians and staff. Median times to wean for patients discharged during the second quarter of 2014 *vs* the third quarter of 2014 were 15 days and 10.5 days respectively.

COMMENTS, CONSIDERATIONS & CONCLUSIONS

- Results of seven months of pilot testing showed a significant decrease in time to wean after implementation of a revised weaning protocol incorporating additional "acceleration" steps while maintaining conservative safety and stability screens; weaning outcomes were essentially unchanged.
- There was a corresponding decrease in length of stay (LOS).
- There are opportunities to further streamline and focus RCP documentation (i.e., mechanism of the failure of the weaning trial).
- Our experience and findings suggest the need to: 1) re-evaluate utility of SIMV mode[4], 2) consider trach collar trial the day following admission[3], 3) allow protocol weaning to proceed based on failure to wean criteria as opposed to limitation of number of steps per day.
- Continued rounding, reinforcement of education, and compliance monitoring will inform these findings.
- Further significant revision will be considered to align with the recent CMS proposed Weaning Process Element Quality Measure on compliance with daily trach collar/self-breathing trials for this population at the LTAC level of care.[5]
- Fewer days on mechanical ventilation may translate to less risk of ventilator-associated complications/events, enhanced rehabilitation opportunities, and shorter LOS.

REFERENCES

1. Scheinhorn DJ, Chao DC, Stearn-Hassenpflug M, et al. Outcomes in post-ICU mechanical ventilation: a therapist-implemented weaning protocol. *Chest* 2001; 119:236-242.
2. Chao DC, Scheinhorn DJ. Determining the best threshold of rapid shallow breathing index in a therapist-implemented patient-specific weaning protocol. Resp Care 2007; 52(2):159-165.
3. Jubran A, Grant BJB, Duffner LA, et al. Effect of pressure support versus unassisted breathing through a tracheostomy collar on weaning duration in patients requiring prolonged mechanical ventilation: a randomized trial. JAMA 2013; 309(7):671-677.
4. Ghamloush M, Hill NS. Synchronized intermittent mandatory ventilation: time to send this workhorse out to pasture. Resp Care 2013 Nov; 58(11):1992-4.
5. CMS Centers for Medicare & Medicaid Services, List of Measures under Consideration for December 1, 2014.

Author contact information: Meg Stearn-Hassenpflug, MS, RD • (213) 202-6863 • mhassenpflug@barlow2000.org