Lung Protective Ventilation in a Rural Level I Trauma Center

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PURPOSE

- Investigate the use of lung protective mechanical ventilation for adult trauma patients arriving at a rural trauma center.
- Investigate the impact of ED ventilator settings on ICU ventilator management.

BACKGROUND

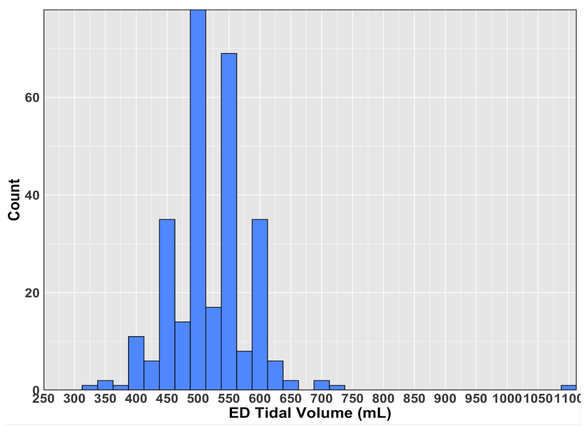
Prior studies demonstrate lung protective ventilation reduces ventilator associated lung injury and improves clinical outcomes. Studies demonstrate ventilator settings in the emergency department (ED) influence the future delivery of lung-protective ventilation in the intensive care unit (ICU), called ventilator inertia.[1] This phenomena was recently shown in patients who were transported by Dartmouth-Hitchcock Advanced Response Team to Dartmouth-Hitchcock ICUs[2]. We assessed mechanically ventilated trauma patients who arrive to a rural trauma center from both the scene of injury and multiple referring hospitals. We aim to identify the use of lung protective ventilation of adult patients upon admission to Dartmouth-Hitchcock Medical Center from the ED.

METHODS

Retrospective review of trauma databases of mechanically ventilated adult (age ≥ 18) trauma patients arriving to Dartmouth-Hitchcock Medical Center (DHMC) between January 2018 and December 2020. Patient characteristics, length of stay, ED CT scan evaluation and timing, patient disposition, and ventilator data were reviewed. Ventilator settings were collected for at the point of ventilator initiation, transition out of the ED, and in the ICU at handoff, 6 and 12 hours. Ideal body weight (IBW) was calculated using the Devine Formula.

RESULTS

Emergency Department Tidal Volumes at Handoff



Handoff Adjusted Tidal Volumes (mL/kg IBW)

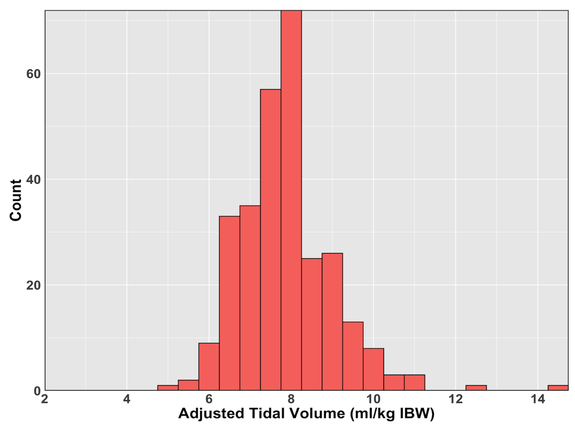


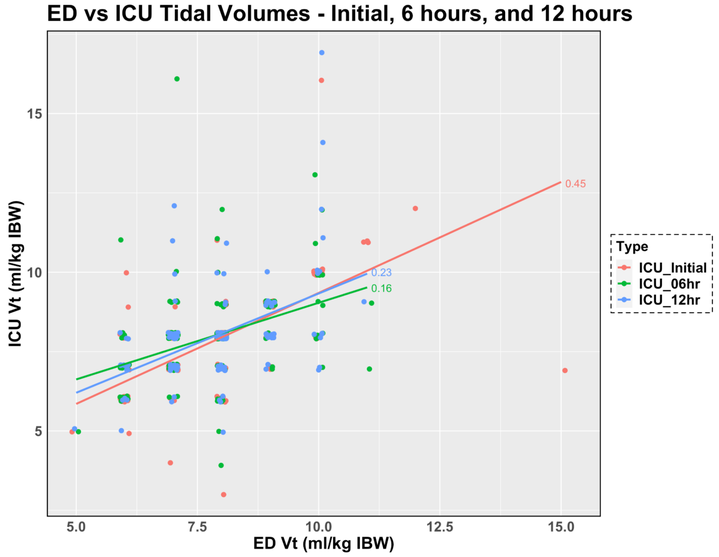
Table-1: Characteristics of Study Participants By Tidal Volume

Characteristic	Low Tidal Volume: < 8 cc/kg IBW n=187	High Tidal Volume: ≥ 8 cc/kg IBW n=125	p value*
Age (years), mean (SD)	48 (18.6)	53 (19.4)	0.02
Sex			< 0.01
Male, n (%)	156 (66.4)	79 (33.6)	
Female, n (%)	31 (39.2)	48 (60.8)	
Height (cm), mean (SD)	176.8 (7.4)	166.5 (8.5)	< 0.01
Weight (kg), mean (SD)	83.7 (20.0)	80.4 (21.7)	0.17
Emergency Department Disposition			
Time in ED (hours), mean (SD)	3.3 (1.9)	3.2 (2.3)	0.67
CT scan Completed, n (%)	148 (79.1)	110 (88.0)	0.90
Ventilator Settings			
PEEP (cm H2O), mean (SD)	5.6 (1.6)	5.5 (1.4)	0.57
FiO_2 (%), mean (SD)	81.0 (27.9)	86.1 (24.9)	0.10

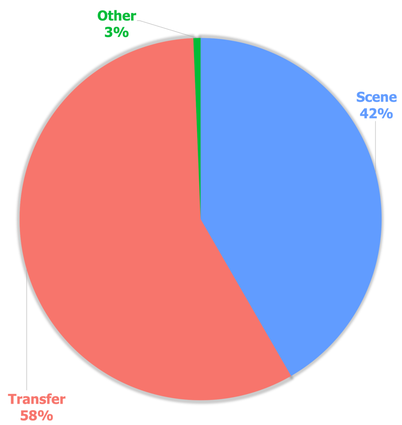
* T test used for continuous variables and chi square test used for categorical variables. A value of $p < 0.05$ is considered significant

- 312 patients met study criteria by being initially ventilated in the DHMC ED and 256 patients were included at handoff to investigate the correlation of ED with ICU ventilator settings.
- Histograms demonstrate the range of tidal volumes (Vt) and ml/kg of IBW at transition from the ED.
- 40% of all patients received ventilation with tidal volumes >8 ml/kg IBW.
- 61% of female patients received ventilation with tidal volumes >8 ml/kg IBW.
- The scatter plot depicts the association between ED handoff Vt and ICU Vt with R^2 values.
- Pie chart shows the percentage of patients arriving from the injury scene or transferred from a referring hospital.

ED vs ICU Tidal Volumes - Initial, 6 hours, and 12 hours



TYPE OF REFERRAL



CONCLUSIONS

- Forty percent of trauma patients who are mechanically ventilated have tidal volumes >8 mL/kg IBW. Female patients are even more likely to have high tidal volume ventilation.
- Tidal volumes of trauma patients in the ED are correlated with ICU tidal volumes
- Our team has identified opportunities for standardization and quality improvement in lung protective ventilation practice of trauma patients in the ED.

NEXT STEPS

- Implementation of a multidisciplinary quality improvement project focusing on lung protective ventilation in trauma patients prior to admission from the ED.

REFERENCES

[1]Fuller BM, Ferguson IT, Mohr NM, et al. Lung-Protective Ventilation Initiated in the Emergency Department (LOV-ED): A Quasi-Experimental, Before-After Trial. Ann Emerg Med. 2017;70(3):406–418.e4.
[2]Roginski, MA, Burney, CP, Husson, EG, et al. Influence of Critical Care Transport Ventilator Management on Intensive Care Unit Care. Air Medical Journal. 2021 https://doi.org/10.1016/j.amj.2021.10.005