Intensive Care Med (2016) 42:1185–1186
DOI 10.1007/s00134-016-4359-7

LETTER

Implementation of an educational program to decrease the tidal volume size in a general intensive care unit: a pilot study

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Dear Editor,

Mechanical ventilation is increasingly recognized as a harmful intervention that could cause lung damage and respiratory muscle injury, frequently referred to as ventilator-induced lung injury (VILI) and ventilator-induced diaphragm dysfunction (VIDD) [1]. In 2000, a large ARDS Network randomized controlled trial [2] convincingly showed that the use of low tidal volumes during mechanical ventilation was associated with reduced mortality in patients with acute respiratory distress syndrome (ARDS).

Epidemiological data suggest that ARDS incidence is decreasing in recent years [3]. Indeed, there has been a paradigm shift from treating ARDS to preventing ARDS (preventing harm by using protective ventilation in patients without ARDS) [1]. Recently, an individual patient data meta-analysis [4] and a review [5] suggested that the use of low tidal volume in patients without ARDS is associated with decreased incidence of pulmonary infection, ARDS, and duration of ventilation. Considering the potential injurious effects of large tidal volume in patients without ARDS, we conducted an educational program in a general intensive care unit (ICU) aiming to reduce the tidal volume delivered to patients without ARDS.

This was a before and after implementation pilot study in one general ICU with 41 beds admitting mixed medical and surgical patients. Tidal volume size of randomly selected patients without ARDS was recorded during 1 month of 2013 in the morning and consisted of the controls used in the study. After this, the implementation phase started in 2014 and consisted of providing lectures instructing respiratory therapists and physicians to (1) measure the height of the patients, (2) calculate the predicted body weight (PBW), and (3) use the lowest tidal volume possible. Also, charts showing the adequate tidal volume target (4–6 ml/kg PBW) for each patient were installed on each ventilator. After this, tidal volume size of randomly selected patients without ARDS was recorded during 1 month of 2015 in the morning to test if the implementation was adequate. All the other treatments delivered to the patients in the study period remained the same. The primary outcome was the decrease in the tidal volume used in patients enrolled in 2015 compared to those enrolled in 2013. The study was approved by the ethics committee of the hospital.

Results from a total of 73 patients were analyzed in the whole period (Table 1). Baseline characteristics were similar between the two periods, with the exception of a higher SAPS III in 2013. The majority of the patients were admitted because of clinical reasons and presented neurological or pulmonary disease (Table 1). There was a significant decrease in the tidal volume size from 2013 to 2015 (Table 1). All other differences are shown in Table 1.

In this pilot study, implementation of a strategy targeting low tidal volume ventilation in patients without ARDS through education and use of charts was shown to be feasible and effective. The before–after design and the low number of patients enrolled meant that this study

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Table 1 Characteristics and results before and after the educational program

	Before (2013) $n = 38$	After (2015) $n = 35$	p value
Age, years	64.9 ± 15.8	62.5 ± 20.9	0.587[b]
Male gender	23/38 (60.5)	17/35 (48.6)	0.305[c]
SAPS III	59.3 ± 17.9	52.7 ± 18.8	0.009[b]
Risk of death	46.7 ± 29.7	35.6 ± 30.0	0.008[b]
SMR	0.45	0.56	–
Type of patients			0.067[c]
Medical	32/38 (84.2)	23/35 (65.7)	
Surgical	6/38 (15.8)	12/35 (34.3)	
Diagnostic			0.041[c]
Infection	7/38 (18.4)	4/35 (11.4)	
Gastrointestinal	9/38 (23.7)	5/35 (14.3)	
Hepatic	0/38 (0.0)	5/35 (14.3)	
Neurologic	9/38 (23.7)	10/35 (28.6)	
Pulmonary	9/38 (23.7)	6/35 (17.1)	
Sepsis	0/38 (0.0)	4/35 (11.4)	
Vascular	1/38 (2.6)	0/35 (0.0)	
Hematological	0/38 (0.0)	1/35 (2.9)	
Cardiac	3/38 (7.9)	0/35 (0.0)	
Mode of ventilation			
Pressure controlled	38/38 (100.0)	35/35 (100.0)	–
Tidal volume, ml/kg PBW	7.6 ± 2.1	6.4 ± 1.5	0.012[b]
PEEP, cmH_2O	9.5 ± 3.6	7.9 ± 190	0.015[b]
Peak pressure, cmH_2O	23.7 ± 4.7	21.6 ± 4.9	0.061[b]
FiO_2	0.3 ± 0.08	0.4 ± 0.16	0.043[b]
PaO_2/FiO_2	323.7 ± 94.7	325.1 ± 152.0	0.966[b]
Delta pressure[a]			0.638[c]
≤16 cmH_2O	32/38 (84.2)	28/35 (80.0)	
>16 cmH_2O	6/38 (15.8)	7/35 (20.0)	
Outcomes			
ARDS	4/38 (10.5)	0/35 (0.0)	0.145[c]
VAP	0/38 (0.0)	0/35 (0.0)	–
VAT	0/38 (0.0)	0/35 (0.0)	–
ICU length of stay, days	9.0 ± 11.4	9.9 ± 10.3	0.600[b]
Duration of ventilation, days	7.4 ± 11.0	4.4 ± 4.3	0.125[b]
ICU mortality	8/38 (21.1)	7/35 (20.0)	0.862[c]

Data are presented as mean ± standard deviation and no./total (%)

MV mechanical ventilation, *SMR* standardized mortality rate, *PBW* predicted body weight, *PEEP* positive end expiratory pressure, FiO_2 inspired fraction of oxygen, *ARDS* acute respiratory distress syndrome, *VAP* ventilator-associated pneumonia, *VAT* ventilator-associated tracheobronchitis, *ICU* intensive care unit

[a] Defined as peak pressure minus PEEP

[b] *t* Student test

[c] Chi-square test

was limited in its ability to address the clinical impact of our strategy.

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Compliance with ethical standards

Conflicts of interest
None.

Accepted: 15 April 2016
Published online: 17 May 2016

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