BAROTRAUMA IN COVID-19 PATIENTS ON MECHANICAL VENTILATION: RESULTS FROM A MULTICENTRIC SURVEY

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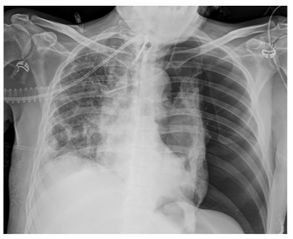
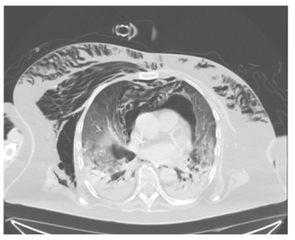
INTRODUCTION

Barotrauma is a feared complication of invasive mechanical ventilation.
The incidence of barotrauma in patients with the coronavirus disease 2019 (COVID-19) on invasive mechanical ventilation is poorly defined. In two small observational studies, it was 12/202 (5.9%) and 7/73 (9.6%) This survey aimed to describe the incidence and risk factors of barotrauma in a large group of patients with COVID-19 treated with invasive mechanical ventilation during our local outbreak (in Lombardy, Italy).



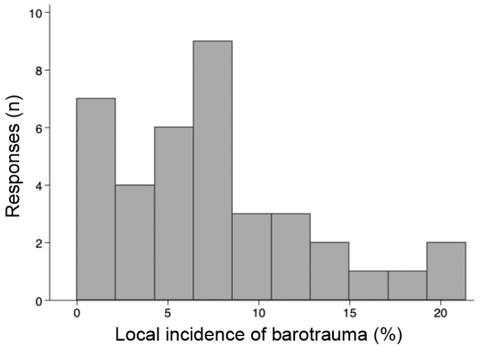


METHODS

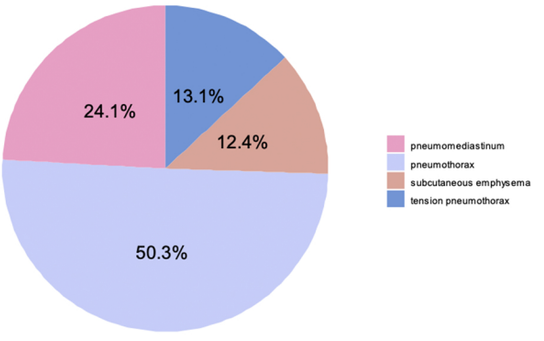
This open, voluntary survey consisted of multiple-choice and open-ended questions prepared with Google Forms. It was disseminated via e-mail to the Directors of the 61 hospitals of the COVID-19 Lombardy Intensive Care Unit (ICU) Network, on March 27th, 2020. Following two reminders, the web-based data entry was closed on May 2nd, 2020.
We compared our results with two other datasets of patients with classic ARDS:
- studies conducted by the VENTILA group from 1998 to 2016
- latest version of the Medical Information Mart for Intensive Care (MIMIC)-III from https://mimic.physionet.org.

RESULTS

The incidence of barotrauma in patients with COVID-19 enrolled in this survey was 7.1% (95%-CI: 6.1-8.3%). This value is probably higher than that in patients without COVID-19. In the two large datasets used for comparison, that collectively enrolled 4094 patients without COVID-19, the incidence of barotrauma ranged from 4.0% to 5.1%.



Herein we show the incidence of de-novo pneumothorax, tension pneumothorax, pneumomediastinum or emphysema in patients with COVID-19 on invasive mechanical ventilation reported by the 38 respondents to the survey.



Different types of barotrauma

Table 1. Ventilatory settings associated with the occurrence of barotrauma.

	COVID-19 (this survey)	Other ARDS (VENTILA group)	Other ARDS (MIMIC-III)	p
N	145	127	64	
Tidal volume (ml/kg IBW)	6.0 (6.0-7.0) N=134	7.6 (6.2-8.5)* N=105	7.1 (5.8-7.9) N=45	<0.001
Positive end-expiratory pressure (cmH_2O)	13 (12-15) N=137	10 (6-13)* N=120	8 (5-10)* N=64	<0.001
Plateau pressure (cmH_2O)	26 (24-29) N=113	27 (22-32) N=76	24 (21-29) N=50	0.084
Driving pressure (cmH_2O)	13 (10-16) N=113	18 (13-22)* N=76	16 (12-19)* N=50	<0.001
With plateau pressure >35 cmH_2O – n	2/113 (2%)	7/76 (9%)	5/50 (10%)	0.038
With driving pressure >15 cmH_2O – n	30/113 (27%)	46/76* (61%)	25/50* (50%)	<0.001
With tidal volume >8 ml/kg IBW or plateau pressure >30 cmH_2O – n	12/134 (9%)	53/113* (47%)	18/58* (31%)	<0.001

Herein we compare the ventilatory settings associated with the occurrence of barotrauma during invasive mechanical ventilation in three different datasets:
(1) patients with acute respiratory failure due to COVID-19 (our present survey);
(2) patients with moderate to severe acute respiratory distress syndrome (ARDS) (VENTILA group);
(3) patients with pneumonia or ARDS, with a PaO2/FiO2 <200 mmHg (MIMIC-III).

On average, patients wth COVID-19 developed barotrauma with lower tidal volume and driving airway pressure but higher PEEP.

Although PEEP may have contributed to barotrauma in some patients with COVID-19, it does not seem to explain our results fully.

P-values refer to the Kruskal-Wallis test and Chi squared test (with Yate's correction for small sample size).
*Adjusted p<0.05 vs. COVID-19.

CONCLUSIONS

In conclusion, patients with moderate or severe ARDS due to COVID-19 may be at high risk for barotrauma during invasive mechanical ventilation. Most of the reported complications occurred with ventilatory settings usually considered lung protective.