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Short communication

Unanticipated demand of Physiotherapist-Deployed Airway Clearance during the COVID-19 Surge 2020 a single centre report



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Abstract

Bronchial secretion management was not an anticipated clinical problem in patients intubated and ventilated with COVID-19. Yet 63 (62%) of our intubated and ventilated patients demonstrated a moderate or greater sputum load, as recorded by physiotherapists on 5 or more days of the patient's ICU stay. The efficacy of airway clearance in these patients was further compounded by ineffective or absent cough and increased secretion tenacity, dramatically increasing the workload of critical care physiotherapists. We provide data to support the modelling of critical care physiotherapy staffing for future COVID-19 surges.

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Introduction

Despite initial reports that 35% of patients severely affected by SARS CoV-2 were productive of sputum [1], bronchial secretion management was not an anticipated clinical problem prior to the UK outbreak in March 2020 [2,3]. However it rapidly became apparent that within the first week of intubation, mechanically ventilated patients developed an airway secretion burden.

Furthermore, clearance of this excess sputum load was often hindered by the levels of sedation and neuromuscular blockade necessary to maintain lung protective strategies, which significantly impaired patients' cough reflexes. These factors necessitated a rapid re-assessment of the expectation of critical care physiotherapy services. The capacity to meet the increased demand was created by redeployment of physiotherapy staff from suspended services elsewhere in the hospital. This capacity may not be available during

future surges given the need to maintain normal non-COVID services.

The combination of early recommendations not to use heated humidification because of Health Care Worker Risk [4], ineffective or absent cough and the possibility of increased secretion tenacity, may lead to retention of secretions, worsening gas exchange and potentially airway occlusion [5,6].

We describe the patient secretion burden, the airway clearance techniques, the frequency with which they were deployed and data to allow modelling of physiotherapy staffing for future outbreaks.

Method

The setting was a 35-bedded UK university hospital ICU with an additional 36 extra capacity beds in the operating theatres/recovery. The ICU is normally staffed at 1:7 physiotherapists to each bed.

Ethical approval was not sought as this was a service evaluation of anonymised data.

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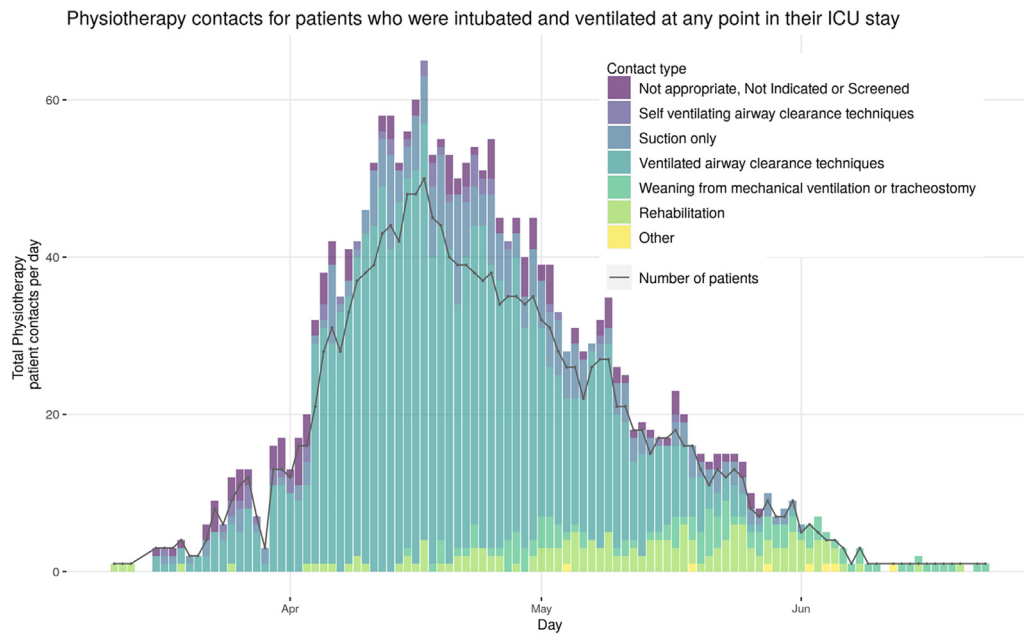


Fig. 1. Physiotherapy interventions with patients who were intubated and ventilated patients during the first COVID-19 wave.

The narrative physiotherapy notes within the electronic healthcare records of all invasively ventilated patients admitted with COVID-19 to these intensive care beds between 8 March and 20 May 2020 were programmatically searched (by authors CB and RK, CB was part of the patients care team) using regular expressions to identify:

- Physiotherapy interventions: chest wall vibrations, ventilator hyperinflation, manual hyperinflation, manual assisted cough, self-ventilating airway clearance techniques, weaning from mechanical ventilation or tracheostomy, and rehabilitation.
- Secretion load: none, minimal, moderate, large, or copious.
- Cough: ineffective, absent, or effective.

Results

One hundred-one patients who received mechanical ventilation were admitted to the ICU beds. The case records of 97 patients with 2171 documented physiotherapy assessments and/or treatment sessions were analysed. Four patients either died or were transferred to another hospital before physiotherapy assessment/treatment.

Sixty-three (62%) of our intubated and ventilated patients demonstrated a moderate or greater sputum load on ≥ 5 days (supplementary Table A and supplementary figure A).

During the first two weeks of a patient's admission, <50% of respiratory physiotherapy treatments recorded the presence of an effective cough (supplementary figure B). Of 947 treatments where cough was ineffective or absent, 507 (53%) resulted in clearance of a moderate or greater secretion volume. Where cough was ineffective or absent physiotherapists

used techniques such as manually assisted cough, chest wall vibrations, manual hyperinflation and ventilator hyperinflation to mobilise and clear airway secretions [7,8]. Of note the performance of manually assisted cough and chest wall vibrations in mechanically ventilated patients requires two skilled clinicians. One thousand four hundred forty (66%) of the documented treatment sessions involved airway clearance techniques in intubated patients (Fig. 1 and supplementary figure C), 80% of which included chest wall vibrations, 32% manually assisted cough, 3% manual hyperinflation and 12% ventilator hyperinflation, with 647 (45%) of the sessions requiring 2 or more of these techniques. Patients received up to 4 treatments per day, with a mean of 1.2 treatments per day.

Discussion

We experienced double the expected number of patients having an excess secretion load, with half of all cases having an ineffective cough presumably due to the use of sedation and neuromuscular blockade during the first 2 weeks of ICU admission. By our calculations, taking into consideration donning, doffing and breaks from personal protective equipment, an individual physiotherapist can treat a maximum of 5 patients who have been intubated and ventilated at any time point in their ICU admission, in a 7.5-hour shift (supplementary figure D). For example 55 intubated and ventilated patients would require 11 whole time equivalent physiotherapists. The staffing ratio is influenced considerably by the number of treatments required per day per patient and the need for 2 physiotherapists to deliver many of the sessions.

Conclusion

Given we expect a lower availability of physiotherapists in subsequent waves, in light of these findings we would recommend that staffing needs are identified and adequately resourced.

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Ethical approval: Not required.

Conflicts of interest: None declared.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at <https://doi.org/10.1016/j.physio.2021.03.010>.

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